DEPARTMENT OF AGRICULTURE.

CHEMICAL DIVISION.

BULLETIN No. 1.

AN INVESTIGATION

OF

THE COMPOSITION

OF

AMERICAN WHEAT AND CORN.

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ASSISTANT CHEMIST.

WASHINGTON:

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1883.

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COMPOSITION OF AMERICAN WHEAT AND CORN.

VARIATIONS IN THE COMPOSITION OF WHEAT AND CORN AS INFLUENCED BY ENVIRONMENT.

The investigation of the wheats and corn of our country, which has been carried on in the laboratory of the Department under my direction for the past two years, is so far completed that the following report upon the results obtained will be of interest.

THE COMPOSITION OF AMERICAN WHEAT.

The wheat grain will be considered first, having absorbed much the largest amount of attention. The specimens which were analyzed are described as follows:

Wheat distributed by the Department in 1878.

Winter Varieties:

1. *Mold's Winter.* Grown in England.
2. *Mold's Red.* Grown in England.
3. *Yellow Missouri.* Grown in Missouri.
4. *Swamp.* Grown in Ohio.
5. *Victor.* Grown in Ontario, Canada.
6. *Silver Chaff.* Grown in Ontario, Canada.
7. *Foizy.* Grown in Oregon.
8. *Brazilian.* Grown in Oregon.
9. *Polish.* Grown in Maryland.
10. *White.* Grown in Oregon.

Spring Wheats:

11. *Improved Life.* Grown in Ontario, Canada.
12. *Champlain.* Grown in New York.
13. *Defiance.* Grown in New York.
14. *Chili Club.* Grown in Oregon.
15. *Noah Island.* Grown in Oregon.

Wheats grown in Colorado by Prof. A. E. Blount in 1881.

719. *Blount's Hybrid, No.* 10. A cross of the New York Diehl on Virginia Golden Straw.

720. *Blount's Hybrid, No.* 15. A cross of the Sonora on the Lost Nation.

721. *Blount's Hybrid, No.* 16. A cross of the Improved Fife on the Russian.

722. *Blount's Hybrid, No.* 16. A cross of the Odessa on the Sonora.

723. *Blount's Hybrid, No* 17. A cross of the Australian Club on the Improved Fife.

724. *Blount's Hybrid, No.* 19. A cross of the Improved Fife on the Oregon Club.

725. *Blount's Hybrid, No.* 20. A cross of the Oregon Club on the Sonora.

726. Seed from New South Wales.

727. *Black Bearded Centennial.* "From seed originally from New South Wales. Probably the heaviest wheat known, 74 pounds per struck bushel. It is an enormous feeder and an enormous yielder. 2 ounces producing, in 1880, 25 pounds 6 ounces."

728. *Eldorado.* "An improvement on the old Egyptian wheat, otherwise called Pharaoh's wheat, Seven-Bearded wheat, Mummy wheat, &c. In Larimer County, Colorado, it produces 90 bushels per acre."

729. *White Mexican or White Siberian.* "It originally came from Siberia. It has held its own more tenaciously than any of the standards. It is liable to rust on damp soils and has a weak straw. It has improved on Colorado soil in ten years of growth."

730. *Judkin.* "A Pennsylvania wheat, and one of the best winter varieties." Professor Blount turned it into a spring wheat in 1878, and it has since proved to be one of the best.

731. *Australian Club.* "One of the most prolific and successful varieties for the farmer. It produced 416 from 1 in 1880. The straw, color, and grain can hardly be excelled. It is no kin to the hard and soft Australian wheats. It is hard and has a large amber kernel."

732. *White Fountain.* "From Montana, and grown in Colorado but one year. It yields 404 from 1, has a stiff, strong, straw, does not rust, and ripens early. It gave 101 pounds from 4 ounces, of smooth, white wheat of great value."

733. *Perfection.* "From Palestine, in 1880, under a variety of names. A half ounce gave 6 pounds of grain and 7 of straw, the latter coarse, strong, and stiff; the grain large, white, and uniform in color."

734. *Russian.* "From Moscow in 1880. One of the best red wheats. Its failing is, shelling too easily when cut too ripe. The first year it produced 76 from 1, the second, 172 from 1, the third year, 448 from 1."

735. *Rio Grande.* "It shells badly."

736. *Touselle.* "From France. It is the finest looking of all the bearded French wheats. It improves rapidly by selection and cultivation."

737. *German Fife.* "From Saxony. Grown in Colorado but one year. One of the best wheats grown anywhere; a bearded red variety. One ounce produced 7 pounds of grain and 8 of straw, 112-fold."

738. *Oregon Club.* "This variety has deteriorated by bad selection.

It is prolific, nevertheless, producing, in 1881, 480 from 1. The seed from Oregon."

739. *Sonora.* "Produced the first year 56 from 1, 110 from 1 the second year, and 448 from 1 the third year. It came from Mexico below the Gulf of California."

740. *Improved Fife.* "It has exhibited no failing in three years, producing, first, 56 from 1, second, 126 from 1, and the third year, 416 from 1."

741. *Lost Nation.* "Seed from Chester County, Pennsylvania, three years before. It produced 352 from 1 in the third year, having given 96 pounds in the second, and 76 from 1 in the first year."

742. *Pringle's Hybrid, No.* 4.

743. *Pringle's Hybrid, No.* 6. "These varieties are from Vermont, and are not profitable, as they shell badly."

747. *Clawson.* "This winter variety refuses almost entirely to be transformed into a spring wheat. In Colorado it has produced the first year 68, the second 136, and the third year 544 from 1."

745. *Hedge Row White Chaff.* "From an unknown source. Too chaffy."

746. *Hedge Row Red Chaff.* "Like the preceding."

747. *White Chaff.* "A bearded variety yielding 400 from 1."

748. *Triticum.* "From Samara, on the Volga River."

749. *Durum.*

750. *Doty.* "These wheats came from Saratov, Russia, in 1880."

751. *Meekins.* "From St. Petersburg."

Seed distributed by the Department in 1882.

752. *Russian Spring Red.* Imported.

753. *French Imperial Spring.* Imported.

From Michigan Agricultural College, Lansing, Mich.

754. *Shumaker.* Crop of 1881. Raised four years consecutively on the college farm. Yield, 15 bushels per acre.

755. *Clawson.* Crop of 1881. Sixth year on college farm. Yield, 20 bushels. The soil at the college farm is a sandy loam, and the season considered a poor one for wheat in that locality.

From Missouri Agricultural College, Columbia, Mo.

756. *Fultz.* Crop of 1879. "Grown in Missouri more than any other."

757. *Shumaker.* Crop of 1879. "Much esteemed."

758. *Zimmerman.* Crop of 1879. "Much esteemed."

759. *Clawson.* Crop of 1879. "Yields best of any sure wheat, but not liked by millers."

760. *Russian, No. 2.* Crop of 1879. "Is a new wheat with us, but promises well."

761. *Smooth Mediterranean.* Crop of 1879. "Highly esteemed."

762. *Silver Chaff.* Crop of 1879. "Most productive. Apt to rust."

In addition to the above comments, Dr. Swallow says that he has sent these varieties as typical of those doing best in Missouri, and has selected the 1879 crop as being above the average.

From F. H. Hosford, Charlotte, Vt.

763. *A crossed wheat.* Labeled $\frac{D}{C}$ '78.

From D. Steck, Pennsylvania.

764. *Hybrid Winter.* Originated by Daniel Steck, Hughesville, Lycoming County, Pennsylvania.

From J. F. Jones, Georgia.

765. *Purple Straw.* Hogansville, Ga.

From J. O. McGehee, Virginia.

766. *Hybrid Winter.* Originated by J. O. McGehee, Bellefont, Nottoway County, Va.

From D. O. Landreth & Son, Philadelphia.

767. *Landreth.* Originated by H. S. Bonnell, Seneca County, New York.

From James Twamley, Dakota.

768. *Castle Fife.* Seed imported and raised by James Twamley. Grand Forks, Dak.

From J. F. Jones, Georgia.

769. *Italian White.* Hogansville, Ga.

770. *Spring wheat.* Hogansville, Ga.

From G. Belshaw, Oregon.

772. *Hudson Bay Winter.* Crop of 1881. George Belshaw, Eugene City, Lane County, Oregon.

773. *Violet Chaff Winter.*

774. *Red Chaff Spring.*

Seed distributed by the Department in 1882.

775. *Tennessee Amber.* Grown by J. W. Sparks, Murfreesborough, Tenn. Crop of 1881.

776. *Osterey Winter.* Imported from Osterey, Russia, in 1876, and

since then has been grown upon the college farm at Columbia. It is a beardless white wheat. Crop of 1882. Sixty-five pounds per bushel. It is said by millers to have good milling qualities.

778. *Swamp.* Grown by J.W. Sparks, Murfreesborough, Tenn. It is the product of Ohio Swamp, grown for several years in Tennessee.

779. *White Mediterranean.* Imported. Weighs sixty-five pounds to the bushel.

From Pickering Dodge, Virginia.

780. *Red Winter.* Grown at Shenandoah Alum Springs, Va., on new ground; no fertilizers. Sown broadcast after moistening and rolling in plaster. Yield, 7 bushels per acre. Crop of 1882.

781. *Red Winter.* The same wheat as 780, grown after corn. Drilled in with lime and manure. Crop of 1882.

Red Winter. Grown at Mount Jackson, Va., on limestone land. Crop of 1882.

From Judge J. M. Robinson, Maryland.

783. *Fultz.* Crop of 1882 used as seed for 1883. The crops for 1883 were collected later, and are numbered 1821 and 1822.

Seed distributed by the Department in 1882.

784. *Red Mediterranean.* Imported seed.

Seed distributed by the Department in 1881, *and crops grown by Professor Blount, Fort Collins, Colorado, in* 1882.

785. *McGehee's Red.* Crop of 1881. Originated by J. McGehee, Bellefontaine, Va.

786. *Crop from* 785. By Professor Blount,of Colorado.

787. *Finlay.* Department distribution.

788. *Finlay.* Professor Blount's crop from 787.

789. *Champion Amber.* A hybrid variety, originated by J. M. Hughes, York, Pa. Crop of 1881.

790. *Champion Amber.* Crop of Professor Blount, from 789 in 1882.

791. *Bill Dallas.* A wheat originated in Georgia. Crop of 1881.

792. *Bill Dallas.* Professor Blount's crop, 1882, from 790.

793. *Bennett.* Department distribution, 1881.

794. *Bennett.* Professor Blount's crop, 1882.

795. *Lemon.* A hybrid of the Champion Amber and Hughes' Prolific, yielding 35 bushels to the acre. Originated by J. M. Hughes, York, Pa. Crop of 1881.

796. *Lemon.* Professor Blount's crop of 1882, from 795.

797. *Gold Medal.* Department distribution of crop of 1881.

798. *Gold Medal.* Professor Blount's crop of 1882 from seed of 1881 distributed by the Department.

799. *German Amber.* Department seed of 1881.

800. *German Amber.* Professor Blount's crop in Colorado in 1882.

801. *Rice.* A variety grown by Milton R. Rice, Frederick, Md.

802. *Rice.* Crop grown by Professor Blount in 1882 from seed of Milton Rice.

803. *Washington Glass.* Seed distributed in 1881 by the Department.

804. *Washington Glass.* Crop of 1882, raised by Professor Blount in Colorado.

805. *Swamp.* The variety described under 778. Another lot distributed by the Department in 1881.

806. *Swamp.* Crop of 1882, grown by Professor Blount from seed distributed by the Department in 1881.

807. *Wysor.* A variety raised by Hugh C. Wysor, Newbern, Pulaski County, Virginia. Crop of 1881, distributed by the Department.

808. *Wysor.* Crop raised by Professor Blount in Colorado, in 1882, from previous seed.

Seed distributed by the Department in 1882.

809. *Rice.* Another portion of that described as 801.

Seed from J. R. Baker, Johnstown, Dak.

810. *Scotch Fife.* Yield, 27½ bushels per acre.

From North Carolina State Fair, 1882.

811. *Kivet.* Grown by J. Reich, Winston, N. C.

812. *Kivet.* Grown by Glenn & Franklin, Winston, N. C.

813. *Rust Proof.* Grown by S. A. Osborn, Winston, N. C.

814. *Rust Proof.* Grown by George Mitchell, Winston, N. C.

815. *Earnhardt.* Grown by J. P. Crews, Winston, N. C.

816. *Golden Premium.* Grown by D. Endsley, Winston, N. C.

817. *Winter Green.* Grown by George Mitchell, Winston, N. C.

818. *Baltimore.* Grown by M. M. Stewart, Salem, N. C.

819. *Baltimore.* Grown by Wm. Myers, Salem, N. C.

820. *White.* Grown by J. E. Mickey, Salem, N. C.

821. *White.* Grown by Albert Ebert, Salem, N. C.

822. *Davis.* Grown by J. L. Pratt, Mount Tabor, N. C.

823. *Davis.* Grown by J. A. Petree, Mount Tabor, N. C.

824. *Purple Straw.* Grown by J. A. Petree, Mount Tabor, N. C.

825. *Purple Straw.* Grown by J. J. Marshall, Lewisville, N. C.

826. *Rust Proof.* Grown by A. E. Conrad, Lewisville, N. C.

827. *Hicks Prolific.* Grown by A. E. Conrad, Lewisville, N. C.

828. *Baltimore.* Grown by R. L. Cox, Ledge Garden, N. C.

829. *Kivet.* Grown by R. L. Cox, Ledge Garden, N. C.

830. *Davis.* Grown by E. N. Spear, Bethania, N. C.

831. *Kivet.* Grown by Jacob Glenn (colored), Winston, N. C.

From Pusey & Shelmire, Avondale, Pa.

832. *Mountain White.* "Forty-four bushels per acre." Crop of 1882.
833. *Mediterranean.* "Sixty-one pounds per bushel."
834. *Fultz.* "Sixty-two pounds per bushel."
835. *Swamp.* "Sixty-four pounds per bushel."

From Louis Flook, Dallas Co., Texas.

1610. *Nicaraguan Wheat.* Yield, 40 bushels per acre. Valued at only 75 cents per bushel on account of its poor milling qualities, being flinty hard.

From V. M. Metcalf, Hopkinsville, Ky.

1280. *Fultz.* Crop of 1879.

From Eastern Experimental Farm, West Grove, Chester County, Pennsylvania.

1281. *Swamp.* Crop of 1879.
1282. *Hedge's Prolific.* Crop of 1879.
1283. *Glick.* Crop of 1879.
1284. *Champion Amber.* Crop of 1879.
1285. *Mediterranean White Chaff.* Crop of 1879.
1286. *Sandimika.* Crop of 1879.
1287. *Fultz.* Crop of 1879.
1288. *Gold Dust.* Crop of 1879.
1289. *Eureka.* Crop of 1879.
1290. *Washington White.* Crop of 1879.
1291. *Clawson.* Crop of 1879.
1292. *Gold Medal.* Crop of 1879.

From Michigan Agricultural College, Lansing, Mich.

1293. *Silver Chaff.* Crop of 1879.
1294. *Louisiana White.* Crop of 1879.
1295. *Jersey Red.* Crop of 1879.
1296. *Power's White.* Crop of 1879.
1297. *Dot.* Crop of 1879.
1298. *Michigan Wick.* Crop of 1879.
1299. *Schaeffer.* Crop of 1879.
1340. *Lancaster Red.* Crop of 1879.
1341. *Velvet Chaff.* Crop of 1879.
1342. *Shumaker.* Crop of 1879.
1343. *Armstrong.* Crop of 1879.
1344. *Muskingum.* Crop of 1879.
1345. *Mediterranean.* Crop of 1879.
1346. *Red Russian.* Crop of 1879.
1347. *Diehl.* Crop of 1879.

1348. *Clawson.* Crop of 1879.
1349. *Jennings' White Winter.* Crop of 1879.
1350. *Buckeye.* Crop of 1879.
1351. *Trump.* Crop of 1879.

Seed distributed by the Department in 1879.

1352. *Fultz.* Grown in Pennsylvania in 1879.
1353. *Centennial Black Bearded* or *New South Wales.* Grown in Baltimore County, Md. Crop of 1879.
1354. *Clawson.* Grown in Greene County, Pennsylvania. Crop of 1879.
1355. *Midge Proof.* Grown in Prince George County, Maryland. Crop of 1879.
1356. *White Australian.* Grown in North Carolina. Crop of 1879.
1358. *Silver Chaff.* Grown in Province of Ontario. Crop of 1879.
1359. *Midge Proof.* Grown in Province of Ontario. Crop of 1879.
1360. *Arnold Victor.* Grown in Province of Ontario. Crop of 1879.
1361. *Harrison.* Grown in Cumberland County, Virginia. Crop of 1879.

From the exhibit of the Saint Paul, Minneapolis and Manitoba Railroad, at the Department of Agriculture.

1900. *Egyptian.* Probably crop of 1881.
1901. *Scotch Fife.* Probably crop 1881.
1902. *Red Fern.* Probably crop of 1881.
1903. *Fife.* Probably crop of 1881.
1904. *Old Letters.* Probably crop of 1881.
1905. *Red Fern.* Probably crop of 1881.
1906. *Fife.* Probably crop of 1881.
1907. *Golden Drop.* Probably crop of 1881.
1908. *White Fife.* Probably crop of 1881.

From the exhibit of the Louisville and Nashville Railroad, at the Department of Agriculture.

1909. *Amber.* Grown in Henry County, Tennessee.
1910. *Fultz.* Grown in Henderson County, Kentucky.
1911. *Red.* Grown by J. W. Harris, Henry County, Tennessee.
1912. *Bearded.* Grown in Carroll County, Tennessee.
1913. *Odessa.* Grown by C. J. Kaufman, Russellville, Ky.
1914. *Fultz.* Grown by W. C. Warfield, Montgomery County, Tennessee.
1915. *Fultz.* Grown by J. B. Killebrew, Montgomery County, Tennessee.
1916. *German Amber.* Grown in Hopkinsville, Ky.
1917. *White.* Grown by Wilson & Co., Lebanon, Ky.
1918. *California Gold Chaff.* From Nashville, Tenn.
1919. *Fultz.* Grown by J. J. Hill & Son, Bowling Green, Ky.

From the exhibit of the Texas Pacific Railroad, at the Department of Agriculture.

1920. *Red.* Grown in Comac County, Texas.
1921. *Red.* Grown in Beaver County, Texas.
1922. *Red.* Grown in Traverse County, Texas.
1923. *Red.* Grown in Beaver County, Texas.
1924. *Amber.* Grown in Williamson County, Texas.
1925. *White.* Grown in El Paso County, Texas.
1926. *Amber.* Grown in Williamson County, Texas.
1927. *Amber.* Grown in Kaufman County, Texas.
1928. *Red.* Grown in Tarrant County, Texas.
1929. *Amber.* Grown in Traverse County, Texas.
1930. *Amber.* Grown in Dallas County, Texas.
1931. *Nicaraguan.* Grown in Milan County, Texas.
1932. *White.* Grown in El Paso County, Texas.
1933. *Red.* Grown in Tarrant County, Texas.
1934. *Red.* Grown in Traverse County, Texas.

From the exhibit of the Atchison, Topeka and Santa Fé Railroad, at the Department of Agriculture.

1935. *White.* Grown in Kansas.
1936. *Red.* Grown in Kansas.
1937. *White.* Grown in Kansas.
1938. *Red.* Grown in Kansas.
1939. *Red.* Grown in Kansas.
1940. *Red.* Grown in Kansas.
1941. *Amber.* Grown in Kansas.
1942. *White.* Grown in Kansas.
1943. *Amber.* Grown in Kansas.
1944. *Red.* Grown in Kansas.

From the Alabama Agricultural Mechanical College, at Auburn, Lee County, Alabama, through Prof. W. C. Stubbs.

The following wheats were grown on a poor and sandy soil, with no fertilizers, which had been in cotton three years without manure. They were sown about the end of November, 1882, and harvested early in June, 1883. They are named and described as follows:

Seed obtained in Philadelphia.

1801. *Lancaster Red.* Yield 450 pounds per acre, 7½ bushels. A bearded variety.

1802. *Smooth Mediterranean.* Yield 600 pounds, 10 bushels to the acre.

1803. *Tuscan Island.* Yield 690 pounds, 11½ bushels per acre. A bearded variety with long yellow heads; rusting slightly.

1804. *Rogers' Red.* Yield, 210 pounds, or 3½ bushels, per acre. Short head; rusted; very late, and mixed.

1805. *Dot.* Yield, 620 pounds, or 10⅓ bushels, per acre. Bearded; dark colored; long heads; no rust.

1806. *Clawson.* Yield, 310 pounds, or 5⅙ bushels. Beardless; rusted.

Seed from the Department.

1807. *Rice.* Yield, 520 pounds, or 8⅔ bushels, per acre. Rusted.

1808. *Bill Dallas.* Yield, 455 pounds, 7$\frac{35}{60}$ bushels, per acre. Rusted but slightly. Seed obtained in 1881 from the Department.

1809. *Tennessee Amber.* Yield, 320 pounds, or 5⅓ bushels, per acre. No rust; long, bright heads.

Seed from Philadelphia.

1810. *Emporium Scott.* Yield, 285 pounds, or 4⅔ bushels, per acre. No value. Rusted.

1811. *Lovell's New White.* Yield, 30 pounds, ½ bushel, per acre. No value. Rusted.

1812. *Washington Glass.* Yield, 170 pounds, 2⅚ bushels, per acre. Late, with rust.

1813. *Eureka White.* Yield, 105 pounds, or 1⅔ bushels, per acre. Late, with rust.

Seed long grown in Lee County.

1814. *Purple Straw.* Yield, 30 pounds, ½ bushel, per acre. Very early. No rust. Seed from Lowther, Lee County, Alabama.

1815. *Kilpatrick Rust Proof.* Yield, 175 pounds, or 2$\frac{55}{60}$ bushels, per acre. Long, bright heads. No rust.

Seed from W. S. Hughes, Athens, Ga.

1816. *Hughe's Rust Proof.* Yield, 440 pounds, or 7⅓ bushels, per acre. No rust. Long heads, and very bright.

Seed from Department.

1817. *Red Mediterranean.* Yield, 239½ pounds, or 4 bushels (nearly) per acre.

From Judge J. M. Robinson, Queen Anne County, Maryland.

1821. *Fultz.* Grown in 1883, from seed analyzed as No. 783, on corn ground, with application of complete commercial fertilizers.

1822. *Fultz.* Same as previous number, but from fallow ground.

Seed distributed by the Department in 1883.

1827. *Michigan Amber.* Grown near Springfield, Ohio, from the variety originally grown in Michigan.

1828. *Red Mediterranean.* Seed imported by the Department in the autumn of 1882, and partially distributed then. This sample is from another portion of the same lot, and is a duplicate of No. 784.

1841. *Black Sea.* This is an imported Russian variety distributed in the autumn of 1883.

1842. *McGhee's White.* A wheat originated and grown by J. O. McGhee, at Bellefont, Va. Distribution in the autumn of 1883.

From Christian Dale, Lemont, Centre County, Pennsylvania.

1831. *Burkholder.* "A variety which yields from 30 to 35 bushels per acre. It is considered the best wheat in the neighborhood."

1832. *Pennsylvania Amber.* "Yields as much as the Burkholder."

1833. *Fultz.* "Yields from 25 to 30 bushels per acre."

These wheats were grown on limestone soil.

From Hugh L. Wysor, Newbern, Pulaski County, Virginia.

1844. *Dallas.* From seed distributed by Department in 1881.

1845. *Fultz-Clawson.* Originated by Mr. Wysor.

These wheats were grown on a very light sandy soil which had no fertilizers. Had been in clover for four years. It was sown broadcast and plowed in. The Dallas is badly winter-killed in Virginia, three-fourths of it being lost. The remainder yielded 15 bushels per acre, weighing 68 pounds per bushel. The Fultz-Clawson is particularly suited to the northwest and middle wheat country.

CROPS FROM DEPARTMENT SEED, 1882–'83.

In June, 1883, a circular letter was addressed to a large number of correspondents who had received wheat from the Department from the seed distributed during the previous autumn. They were requested to return samples of the crop which they had been able to raise, and to answer the following questions:

1. Name.
2. Town, County, and State in which the wheat was grown.
3. Name of cereal.
4. Character of soil.
5. Fertilizers applied, and previous treatment of the soil.
6. Method of cultivation.
7. Yield per acre and weight per bushel.

In reply the following specimens and answers were received:

1807, 1808, 1817.

1. W. C. Stubbs.
2. Auburn, Lee County, Alabama.
3. 1807. *Rice Wheat.*
   1808. *Bill Dallas.* Distribution of 1881.
   1817. *Red Mediterranean.*

4. Sandy, and very poor.
5. No fertilizers. In cotton the past three years without manure.
6. Sandy, broken with one-horse turn-plow, seed sown broadcast by hand, slightly plowed in with scooter, and harrowed.
7. 1807. Rice, 520 pounds grain = 8⅔ bushels.
   1808. Bill Dallas, 320 pounds grain = 5⅓ bushels.
   1817. Red Mediterranean, 239 pounds grain = 4 bushels (nearly).

1818. *Red Mediterranean.*

1. Thos. P. McConnell.
2. Fayette, Fayette County, Alabama.
3. Red Mediterranean.
4. "Red clay with some sand."
5. No fertilizers, continuous cropping.
6. Sown broadcast and plowed in.
7. Seven bushels per acre, medium quality.

1819. *Red Mediterranean.*

1. C. B. Richardson.
2. Henderson, Rush County, Texas.
3. Red Mediterranean.
4. Reddish sandy.
5. Had been cultivated in turnips previous autumn. Wheat sown 13th January, cut down by hard freeze on the 22d January. The furrows had some cotton seed thrown in when the wheat was planted, and was cultivated by the sweep with two furrows only, once. It rusted, as all wheat I ever tried on my place has done, except the hard Nicaraguan.
7. The yield might have been 3 bushels per acre if it had been gathered.

1820. *Red Mediterranean.*

1. J. J. Barclay.
2. Lawrence County, Alabama.
3. Red Mediterranean.
4. Clay loam.
5. No fertilizers. In corn previous year.
6. Wheat sown after breaking ground on 15th October, and harrowed in.
7. 14 bushels; 60 pounds per bushel.

1823. *Red Mediterranean.*

1. B. J. Russell.
2. Milford, Baker County, Georgia.
3. Red Mediterranean.
4. Sandy, with clay subsoil.
5. Thoroughly pulverized, harrowed, and 200 pounds compost of cotton seed and cow manure well rotted applied to the acre. Seed and compost harrowed in together.

6. Sown broadcast and harrowed once in the spring.
7. Twenty-five bushels per acre.

1824. *White Mediterranean.*

1. B. F. Jarrell.
2. Rover, Bedford County, Pennsylvania.
3. White Mediterranean.

1825. *White Mediterranean.*

1. J. M. Stratton.
2. Benvanue, Clay County, Texas.
3. White Mediterranean.
4. Chocolate loam of Red River Valley.
5. No fertilizers.
6. Raised on millet stubble turned under, sown broadcast, and harrowed in.
7. Twenty bushels per acre.

1826. *Red Mediterranean.*

1. I. L. Goforth.
2. Bear Creek, Parker County, Texas.
3. Red Mediterranean.
4. "Gray lime, valley land."
5. No fertilizers; last year in wheat.
6. Mowed the land off in September; set fire to it and burnt clean in October; broke 3 inches deep; harrowed and sowed by drill; one bushel per acre,
7. Twenty-three and twenty-sixtieths bushels per acre; 61 pounds per bushel.

1829. *White Mediterranean.*

1. Lewis B. Thornton.
2. Tuscumbia, Colbert County, Alabama.
3. White Mediterranean.
4. High lands, rich and sandy. Fair sample of Tennessee Valley soil.
5 and 6. No fertilizers, except natural growth plowed in. Soil broken and wheat harrowed in late. Heavy rains till harvest.
7. Poor yield; 5 bushels per acre, which might weigh 60 pounds per bushel.

1830. *Osterey.*

1. John E. Dye.
2. Philadelphia, Hancock County, Indiana.
3. Osterey.
4. Heavy clay.
5. None.
6. The ordinary cultivation for wheat, except that this was drilled in corn.
7. About 10 bushels.

1834. *White Mediterranean.*

1. Irving Spence.
2. Snow Hill, Worcester County, Maryland.
3. White Mediterranean.
4. Light, rather sandy loam, with red clay subsoil.
5. No fertilizers applied. The land had raised a crop of Indian corn in 1882.
6. Wheat not received till November. Seeded last of that month. A succession of heavy rains followed; but for this would have had a good yield.
7. Seeded at the rate of one bushel to the acre, or three-fourths peck on three-sixteenths acre. Harvested 2 bushels. Weight, 60½ pounds per bushel.

1835. *Tennessee Amber.*

1836. *Rice.*

1. R. H. Query.
2. Shawnee Cape Girardeau County, Missouri.
3. Tennessee Amber and Rice.
4. Clay with humus, clovered.
5. No fertilizers. Second crop of last year's clover turned under about 1st September. Harrowed once before seeding.
6. No further cultivation.
7. Twenty-two and one-half bushels per acre, 62 pounds per bushel for the Tennessee Amber. One pound of Rice yielded 32 pounds of grain.

1837. *Rice.* 1882 crop. From seed of 1881.

1838. *Rice.* 1883 crop.

1. J. F. Brents.
2. Albany, Clinton County, Kentucky.
3. Rice.
4. Limestone, with some clay and gravel.

5 and 6. Sod turned under, cultivated in corn, corn cut, and a heavy sod of crab grass turned under. Wheat sown broadcast and harrowed.

7. Yield 1882, 12 bushels; in 1883, 8½ bushels; 63 grains to the head.

1839. *Red Mediterranean.*

1. W. D. H. Johnson.
2. Holton, Bibb County, Georgia.
3. Red Mediterranean.
4. Dark red clay loam.

5 and 6. No fertilizers. In corn previous year. Land broken 4 inches deep; wheat sown at the rate of one-half bushel per acre, and a drag run over it.

7 Rate per acre, 7 bushels. Weight, 57 pounds per bushel.

1840. *Rice.*

1. Thomas J. Mason.
2. Loudon, Loudon County, Tennessee.
3. Rice. Second crop.
4. Gravelly soil, with clay subsoil. Second class land.
5, 6, and 7. No fertilizers used the first year. The land was in wheat the year before. It was turned, harrowed, and rolled, and the wheat then drilled in in the first week in October. It rusted, but there were harvested 8 bushels. This was drilled the second year on 8 acres and yielded in 1883 22½ bushels per acre.

1843. *White Mediterranean.*

1. Dr. Thomas W. Roane.
2. Covington, Tipton County, Tennessee.
3. White Mediterranean.
4. Dark loam. In cultivation thirty years. Medium fertility.
5. None applied. Land worked in cotton; grain seeded on the standing cotton stalks and put on with cultivator 1½ to 2 inches deep. Too late for wheat when seeded, and consequently rusted.
7. Eight bushels.

CHARACTER OF THE SPECIMENS.

The wheats included in the preceding list are with a few exceptions winter varieties. They are as a rule selected specimens, and are, if anything, rather above than below the average composition of the portions of the country from which they came. This is probably the case with the railroad exhibits where the fairest and finest grain has been collected for the display of the possible resources of the neighboring lands. In several instances, however, samples typical of the poorest wheat which is grown have been obtained, so that the extremes of production are well represented in the analyses. The seed which has been distributed by the Department has of course been from selected lots of grain, and together with the crops produced should be above the average of the country.

It is plain, then, that our averages which are deduced from the analyses of these samples will be favorable to a higher and better composition of the grain than actually exists.

METHOD OF ANALYSIS.

The samples of grain were immediately catalogued on their receipt and given a serial number by which they were known throughout the subsequent work upon them. Thirty or more grams were carefully cleaned from dirt, chaff, and foreign seed, and one hundred grains or kernels, selected at random, weighed, and the result recorded in grams and milligrams. The specimen was then rubbed up in a large iron mortar until the whole passed a sixty-mesh sieve, after which any iron which might have been introduced was removed by a magnet.

The fine flour was then analyzed as follows: One gram was dried in a porcelain crucible at 100°–105° C. until it ceased to lose weight. It was then burned in a gas muffle furnace and the ash weighed. In a few analyses, where the water falls below 8 per cent., the determinations may be a per cent. too low, owing to the fact that they were made in a drying oven with a temperature of only 95° C. They are so few in number as not to essentially modify the result.

For oil two grams were extracted in a continuous percolation apparatus with ether or petroleum ether, either solvent giving the same result. A battery of eighteen percolators allowed this work to be done very rapidly.

The fiber was obtained by alternate treatment with acid and soda in the usual manner, except that as the operation was conducted on a large steam bath of fifteen holes heated by live steam from our boiler, the length of time for digestion was increased to two hours and the strength of acid and soda to 5 per cent., the heat of the bath never raising the liquid above 95° C. Comparisons of this modification and the original Weende method, of actual boiling with weaker acid, showed the results to be concordant.

The nitrogen was determined by combustion with soda-lime, receiving the ammonia in fifth normal standard oxalic acid and titration with standard sodic hydrate which had been compared with normal hydrochloric acid standardized gravimetrically

In several analyses after the extraction of the oil by ether, the residue was percolated with 80 per cent. alcohol in the same apparatus, removing sugar and soluble albuminoids which were separated by water. The albuminoids, of course, included the soluble portions of the gluten of the wheat, and the difference between the amount found in the alcohol extract and the total amount obtained by multiplying the nitrogen, found by combustion, by the factor 6.25, was stated as insoluble albuminoids, and consisted of the true albumen or cerealine and the gluten casein. After the extraction with alcohol the residue was rubbed up with water and allowed to stand a short time at ordinary temperatures. An aliquot portion of the filtrate, evaporated and dried, was stated as dextrine. It is a question, if this was ready formed in the grain to any extent; at times soluble starch was present, and there is a suspicion that both were formed by the action of some ferment on the starch in presence of water. It also, of course, contained a small amount of soluble albumen. As these determinations were very troublesome and did not furnish results which adequately repaid the labor involved, they were given up in the later analyses.

Determinations of specific gravity were attempted, but with such variable results that they were of slight value and were given over. Piknometers were used with water and with oil, but different samples from the same specimen of grain would apparently vary as much as quite different varieties.

Determinations of gluten mechanically were of more interest, and were made in all cases where the grain was received fresh from the harvest and in amount sufficient to allow it, but, as will be shown later, attempts with wheats which had been preserved a year or two led to erroneous results.

How far the methods and results can be depended on is, I think, shown in the following analyses of two samples of Red Mediterranean wheat taken from the same heap, the one in 1882, the other in 1883.

RED MEDITERRANEAN WHEAT.

	1882.	1883.
Water	9.83	9.88
Ash	1.70	1.62
Oil	2.21	2.06
Carbhydrates	73.73	73.80
Fiber	1.68	1.79
Albuminoids	10.85	10.85

It may be said, too, that no one engaged in these analyses had the slightest idea that the two specimens were duplicates. The work has been often duplicated in the matter of single determinations, which seemed irregular, and with the systematic methods of carrying it on it is known that the results can be depended on. Our facilities are at present equal to the analyses of twelve wheats a day, and it is hoped that specimens typical of several portions of the country, such as New York and California, which have not been examined, may be obtained for a continuation and extension of the work.

THE RESULTS.

The results which have been obtained by the methods just described are presented in the following tables, and for a clear exposition are arranged by States. The headings to the columns explain themselves, merely repeating that the weight of 100 grains or kernels is in grams and milligrams; that the *carbhydrates*, which include the sugar, dextrine, and starch of the grain, are found by difference between 100 per cent. and the amount of water, ash, oil, and fiber determined, and that the albumen or albuminoids is equivalent to the nitrogen multiplied by the factor 6.25.

A table of analyses which have been made by other investigators is presented, and the results contained therein have been distributed among the several States to which they belong, and properly accredited, in order that a complete list of the wheat analyses which have been made in this country might be collected in one place. The special railroad exhibits have, in addition, been arranged by themselves.

ANALYSES OF WHEATS FROM OTHER SOURCES THAN THE DEPARTMENT OF AGRICULTURE.

No.	Name.	Locality.	Year.	Weight of 100 grains.	Water.	Ash.	Fat.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Analyst.
				Grams.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
1	White extra	Michigan	1877		12.75	1.56	1.26	70.96	1.83	11.64	1.87	Atwater.
2	Red	Missouri	1877		13.52	1.55	1.47	69.95	1.72	11.79	1.89	Do.
3	Diehl	Michigan	1876									
4	------do	---do	1876		9.64	1.72		76.26		12.38	1.98	Kedzio.
5	------do	---do	1876		12.18	1.82		72.22		13.78	2.20	Do.
6	------do	---do	1876		12.68	1.77		73.74		11.81	1.89	Do.
7	Soules	----do	1876		10.25	1.50		76.37		11.88	1.90	Do.
8	------do	British Columbia	1876		11.02	1.73		75.44		11.81	1.89	Do.
9	------do	do	1876		8.51	1.63		77.61		12.25	1.96	Do.
10	------do	Michigan	1876		11.22	2.09		74.81		11.88	1.90	Do.
11	Lincoln	----do	1876		10.07	1.89		74.59		13.45	2.16	Do.
12	------do	----do	1876		13.38	1.56		73.16		11.90	1.90	Do.
13	Fultz	----do	1876		10.78	1.75		76.09		11.38	1.82	Do.
14	------do	----do	1876		11.45	1.74		75.22		11.59	1.86	Do.
15	Treadwell	----do	1876		12.53	1.74		71.26		14.47	2.31	Do.
16	----- do	----do	1876		12.69	1.71		73.10		12.50	2.00	Do.
17	------do	--- do	1876		9.94	1.80		76.57		11.69	1.87	Do.
18	Buckeye	----do	1876		10.00	1.76		76.36		11.88	1.90	Do.
19	Tappahannock	----do	1876		12.73	1.38		74.92		10.97	1.75	Do.
20	Lancaster	----do	1876		11.21	1.77		73.46		13.56	2.17	Do.
21	Asiatic	----do	1876		11.93	1.82		72.25		14.00	2.24	Do.
22	Gold Medal	--- do	1876		11.11	1.70		74.94		12.25	1.96	Do.
23	------do	-- do	1876		10.55	1.73		76.57		11.15	1.78	Do.
24	Egyptian	----do	1876		10.12	2.00		74.82		13.00	2.08	Do.
25	Clawson	-- do	1876		11.48	1.69		75.64		11.19	1.79	Do.
26	------do	-- do	1876		12.29	1.64		74.19		11.88	1.90	Do.
27	------do	----do	1876		11.30	1.74		76.02		10.94	1.75	Do.
28	------do	----do	1876		12.29	1.79		74.76		11.16	1.78	Do.
29	------do	----do	1876		10.36	1.64		76.19		11 81	1.89	Do.
30	------do	----do	1876		11.19	1.76		74.99		12.06	1.93	Do.
31	------do	----do	1876		11.09	1.64		74.89		12.38	1.98	Do.
32	------do	----do	1876		11.08	1.49		75.18		12.25	1.96	Do.
33	----- do	----do	1876		10.43	1.70		75.18		12.69	2.03	Do.
34	------do	---- do	1876		10.31	1.60		75.84		12.25	1.96	Do.
35	------do	Oregon	1876		13.00	1.79		73.84		11.37	1.82	Do.
36	Wecks	Michigan	1876		12.99	1.77		74.74		10.50	1.68	Do.
37	Powers	--- do	1876		10.03	1.59		77.38		11.00	1.76	Do.
38	Armstrong	do	1876		10.85	1.70		75.42		12.03	1.92	Do.
39	Tuscan	----do	1876		12.21	1.97		72.94		12.88	2.06	Do.
40	Post	----do	1876		13.77	1.72		73.14		11.37	1.82	Do.
41	Sonora Club	Oregon	1876		10.27	1.58		76.90		11.25	1.78	Do.
42	Minnesota No. 1	Minnesota	1882	2.732	10.91	1.46		77.90		10.63	1.70	Do.
43	Minnesota No. 2	----do	1882	2.109	12.34	1.59						
44	Minnesota No. 3	do	1882	2.037	11.31	1.92		70.98	2.03	13.06	2.09	Noyes.
45	Unmanured	Pennsylvania	1882		11.85	1.97		71.40	2.37	13.00	2.08	Do.
46	$P_2O_5 + K_2O$	--- do	1882		13.33	2.04		70.12	2.50	13.56	2.17	Do.
47	$P_2O_5 + K_2O + {}_1N$	-- do	1882		13.04	1.99	1.99	69.02	2.76	10.86	1.74	Jordan.
48	$P_2O_5 + K_2O + {}_2N$	----do	1882		13.16	2.03	1.97	69.35	2.65	10.50	1.67	Do.
49	$P_2O_5 + K_2O + {}_3N$	----do	1882		13.06	2.98	1.90	69.24	2.51	11.16	1.78	Do.
50	Manured	----do	1882		12.59	1.83	1.90	68.90	2.47	11.69	1.87	Do.
					12.41	2.09	1.92	69.53	2.53	11.70	1.88	Do.
							1.89	70.10	2.37	11.04	1.76	Do.

Serial number.	Name.	Spring or winter.	Color.	Consistency.	Year of growth.	Weight of 100 grains.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Analyst.
						Grams.	*Per ct.*	*P. ct.*	*P. ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	
	CANADA:													
5	Victor	Winter	Yellow	.....	1878	3.408	7.49	1.39	2.27	77.71	1.69	9.45	1.51	Department of Agriculture.
6	Silver Chaff	...do	.....	.....	1878	3.686	8.93	1.58	2.44	75.41	1.75	9.89	1.58	Do.
11	Impr. Fife	Spring	.....	.....	1878	.....	8.50	1.47	2.56	71.15	1.62	14.70	2.35	Do.
1358	Silver Chaff	Winter	Yellow	.....	1879	3.597	11.05	1.90	2.28	73.27	1.70	9.80	1.57	Do.
1359	Midge Proof	...do	White	.....	1879	2.964	11.60	1.45	2.04	73.43	1.68	9.80	1.57	Do.
1360	Arnold's Victor	...do	Yellow	.....	1879	2.972	10.90	1.60	2.14	72.23	1.58	11.55	1.85	Do.
	VERMONT:													
763	Cross	Winter	Yellow	Glassy	1881	4.073	10.87	1.75	2.04	72 13	2.52	10.69	1.71	Department of Agriculture.
	NEW YORK:													
12	Champlain	Spring	.....	.....	1878	.....	8.79	2.05	2.55	69.72	1.49	15.40	2.46	Department of Agriculture.
13	Defiance	...do	.....	.....	1878	.....	8.12	1.57	2.49	71.78	2.04	14.00	2.24	Do.
767	Landreth	Winter	.....	Soft	1882	4.541	11.43	2.10	2.02	71.85	1.75	10.85	1.74	Do.
	PENNSYLVANIA:													
	Unmanured	Winter	.....	.....	1882	.....	13.33	2.04	1.99	69.02	2.76	10.86	1.74	Jordan.
	$P_2O_5 + K_2O$	...do	.....	.....	1882	.....	13.04	1.99	1.97	69.85	2.65	10.50	1.67	Do.
	$P_2O_5 + K_2O + N$	...do	.....	.....	1882	.....	13.16	2.03	1.90	69.24	2.51	11.16	1.78	Do.
	$P_2O_5 + K_2O + 2N$	...do	.....	.....	1882	.....	13.06	2.98	1.90	67.90	2.47	11.69	1.87	Do.
	$P_2O_5 + K_2O + 3N$	...do	.....	.....	1882	.....	12.59	1.83	1.92	69.53	2.53	11.70	1.88	Do.
	Manured	...do	.....	.....	1882	.....	12.41	2.09	1.89	70.10	2.37	11.04	1.76	Do.
789	Champion Amber	...do	Amber	Hard	1881	3.278	8.95	1.90	2.21	74.56	1.35	11.03	1.76	Department of Agriculture.
795	Lemon	...do	Yellow	...do	1881	3.417	8.35	1.90	2.51	70.13	1.53	15.58	2.49	Do.
797	Gold Medal	...do	...do	...do	1881	3.076	8.60	1.80	2.37	76.05	1.38	9.80	1.57	Do.
799	German Amber	...do	Amber	...do	1881	2.938	7.60	1.70	2.64	75.98	1.05	11.03	1.76	Do.
803	Washington Glass	...do	Yellow	...do	1881	3.741	8.45	2.05	2.23	73.44	1.75	12.08	1.93	Do.
1280	Swamp	...do	Red	...do	1879	4.063	9.95	1.65	2.13	71.94	1.55	12.78	2.04	Do.
1282	Heiges Prolific	...do	...do	...do	1879	3.097	10.00	1.15	1.77	75.07	1.33	10.68	1.71	Do.
1283	Glick	...do	...do	...do	1879	3.958	11.55	1.80	2.10	70.50	1.80	12.25	1.96	Do.
1284	Champion Amber	...do	...do	...do	1879	3.210	9.90	1.85	2.41	72.74	1.90	11.20	1.79	Do.
1285	Medit. White Chaff	...do	...do	...do	1879	3.853	10.05	1.70	2.30	72.04	1.83	12.08	1.93	Do.
1286	Saudamika	...do	...do	...do	1879	2.085	11.30	1.30	2.15	71.05	1.60	12.60	2.02	Do.
1287	Fultz	...do	Amber	...do	1879	3.275	11.40	.90	1.51	74.79	.90	10.50	1.68	Do.
1288	Gold Dust	...do	Yellow	...do	1879	2.526	11.45	.80	1.61	74.61	1.03	10.50	1.68	Do.
1289	Eureka	...do	...do	...do	1879	3.238	10.50	1.35	2.14	72.86	1.60	11.55	1.85	Do.
1290	Washington Glass	...do	...do	...do	1879	3.596	10.40	1.05	1.90	73.87	1.23	11.55	1.85	Do.
1291	Clawson	...do	...do	...do	1879	3.120	10.60	1.60	2.09	72.10	2.23	11.38	1.82	Do.
1292	Gold Medal	...do	...do	...do	1879	2.578	11.45	.90	1.39	74.60	.98	10.68	1.71	Do.
832	Mountain	...do	White	Soft	1882	2.710	9.50	1.70	2.38	75.12	1.32	9.98	1.60	Do.

835	Mediterranean	...do	Amber	Hard	1882	4.060	8.85	1.65	2.25	74.45	1.25	11.55	1.85	Department of Agriculture.
834	Fultz	...do	...do	.. do	1882	3.020	9.55	1.80	2.30	75.20	1.70	9.45	1.51	Do.
1352	Do	.. do	Red	Medium.	1879	3.473	11.00	1.40	2.11	72.38	1.73	11.38	1.82	Do.
1354	Clawson	...do	Yellow	Hard	1879	4.292	11.35	1.90	1.90	71.90	1.75	11.20	1.79	Do.
764	Hybrid	...do	Amber	...do	1881	2.989	11.50	1.50	2.22	71.80	1.78	11.20	1.79	Do.
1831	Burkholder	...do	White	Soft	1883	4.658	10.78	1.93	1.93	73.53	1.69	10.15	1.62	Do.
1832	Pennsylvania Amber	...do	Amber	Medium.	1883	3.641	10.72	1.98	1.91	72.06	1.95	11.38	1.82	Do.
1833	Fultz	...do	..do.	..do	1883	3.882	11.45	1.97	1.46	69.61	1.86	13.65	2.18	Do.
	MARYLAND:													
9	Polish	Winter			1878		10.08	1.67	2.67	71.59	1.56	12.43	1.99	Department of Agriculture.
801	Rice	...do	Red	Hard	1881	3.586	8.40	2.15	2.32	70.97	1.63	14.53	2.32	Do.
783	Fultz	...do	Amber	...do	1882	3.198	11.06	1.85	1.98	73.43	1.70	9.98	1.60	Do.
809	Rice	...do	Red	...do	1882	3.075	10.00	1.80	2.18	71.91	1.86	12.25	1.96	Do.
1353	Centennial Amber	...do	Yellow	Medium.	1879	5.079	11.05	2.05	2.11	71.03	1.68	12.08	1.93	Do.
1355	Midge Proof	.. do	...do	Soft	1879	3.077	9.45	1.35	1.93	74.79	1.63	10.85	1.74	Do.
1821	Fultz	...do	Amber	Hard	1883	3.685	11.34	1.66	2.27	73.21	1.72	9.80	1.57	Do.
1822	Do	...do	...do	.. do	1883	3.602	11.38	1.64	1.55	72.99	1.59	10.85	1.74	Do.
1834	White Mediterranean	.. do	White	Soft	1883	3.472	11.92	1.63	1.77	70.30	2.30	12.08	1.93	Do.
	VIRGINIA:													
785	McGehee's Red	Winter	Red	Hard	1881	2.811	8.80	1.05	2.49	72.53	1.48	13.65	2.18	Department of Agriculture.
787	Finlay	...do	...do	...do	1881	3.285	9.45	1.60	2.38	73.67	1.18	11.72	1.88	Do.
766	Hybrid	.. do	...do	...do	1882	3.652	11.54	1.65	2.00	70.30	1.73	12.78	2.04	Do.
780	Shenandoah, 1	...do	...do	...do	1882	1.830	9.45	2.45	2.18	70.02	1.90	14.00	2.24	Do.
781	Shenandoah, 2	...do	...do	...do	1882	2.655	11.15	1.60	2.56	72.76	1.78	10.15	1.62	Do.
782	Shenandoah, 3	...do	...do	..do	1882	3.196	9.28	2.00	2.38	73.16	1.63	11.55	1.85	Do.
1361	Harrison	...do	.. do	...do	1879	3.708	11.14	1.86	2.46	71.11	1.70	11.73	1.88	Do.
1842	McGehee's White	.. do	White	Soft	1883	3.500	9.35	1.60	1.85	72.81	1.96	12.43	1.99	Do.
1844	Dallas	...do	Red	Medium.	1883	4.137	12.26	1.58	1.83	69.59	1.96	12.78	2.04	Do.
1845	Fultz-Clawson	...do	...do	...do	1883	4.208	12.10	1.80	2.01	71.84	1.75	10.50	1.68	Do.
807	Wysor	...do			1881	3.796	9.25	1.55	2.16	72.71	1.73	12.60	2.02	Do.
	GEORGIA:													
791	Dallas	Winter	Amber	Hard	1881	4.023	7.95	2.15	2.48	73.17	1.65	12.60	2.02	Department of Agriculture.
793	Bennet	...do		.. do	1881	3.218	8.05	2.05	2.22	72.30	1.38	14.00	2.24	Do.
769	Italian White	...do		...do	1882	4.627	11.22	1.70	2.68	73.47	1.48	9.45	1.51	Do.
770	Spring	Spring		...do	1882	2.946	10.92	1.80	2.40	71.55	2.13	11.20	1.79	Do.
765	Purple Straw	Winter	Red	...do	1882	4.512	10.49	2.30	2.12	73.46	1.48	10.15	1.62	Do.
1839	Red Mediterranean	...do	...do	...do	1883	2.894	9.19	2.04	2.13	72.18	2.03	12.43	1.99	Do.
1823	Do	...do	...do	...do	1883	2.834	12.20	1.66	2.09	69.57	1.88	12.60	2.02	Do.
	NORTH CAROLINA:													
811	Kivet	Winter.	Yellow.	..Hard...	1882	4.230	11.70	1.55	2.22	71.22	2.28	11.03	1.76	Department of Agriculture.
812	Do	...do	...do	...do	1882	3.628	11.65	1.80	2.11	73.86	1.65	8.93	1.43	Do.
829	Do	...do	...do	...do	1882	4.388	10.15	1.50	2.15	72.52	1.43	12.25	1.96	Do.
831	Do	...do	...do	...do	1882	3.385	10.90	1.50	2.32	73.18	2.12	9.98	1.60	Do.
813	Rust Proof	...do	Red	Medium.	1882	4.301	10.40	1.55	2.39	72.46	2.87	10.33	1.65	Do.
814	Do	...do	...do	...do	1882	4.035	10.60	1.45	2.33	72.63	2.84	10.15	1.62	Do.
826	Do	...do	...do	...do	1882	4.628	9.30	1.80	2.25	75.42	1.95	9.28	1.43	Do.
818	Baltimore	...do	Yellow	...do	1882	3.906	9.55	1.60	2.28	75.05	1.54	9.98	1.60	Do.
819	Do	...do	...do	...do	1882	3.433	9.85	1.45	2.32	74.08	1.10	11.20	1.79	Do.
820	Do	...do	...do	.. do	1882	3.925	9.65	1.65	2.25	76.35	1.00	9.10	1.46	Do.
821	Do	...do	...do	...do	1882	3.330	9.20	1.85	2.06	75.14	1.60	10.15	1.62	Do.
828	Do	.. do	...do	...do	1882	4.155	9.70	1.65	2.16	73.48	1.63	11.38	1.82	Do.

ANALYSES OF AMERICAN WHEATS ARRANGED BY STATES—CONTINUED.

Serial number.	Name.	Spring or winter.	Color.	Consistency.	Year of growth.	Weight of 100 grains.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Analyst.
	NORTH CAROLINA—Continued.					*Grams.*	*Per ct.*	*P. ct.*	*P. ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	
824	Purple Straw	Winter	Red	Hard	1882	3.236	9.40	1.70	2.47	74.58	1.70	10.15	1.62	Department of Agriculture.
825	Do	do	do	do	1882	2.780	10.55	1.35	2.42	72.12	1.66	11.90	1.90	Do.
823	Davis	do	do	do	1882	3.756	8.45	1.75	2.28	73.26	2.53	11.73	1.88	Do.
822	Do	do	do	do	1882	3.285	8.35	1.60	2.43	76.50	.44	10.68	1.71	Do.
830	Do	do	do	do	1882	3.702	11.05	1.55	2.31	70.85	1.81	12.43	1.99	Do.
815	Earnhardt	do	Yellow	Soft	1882	3.951	10.92	1.30	2.10	74.07	1.63	9.98	1.60	Do.
816	Golden Premium	do	do	do	1882	4.374	10.66	1.70	2.03	74.44	1.54	9.63	1 54	Do.
817	Wintergreen	do	do	do	1882	3.567	9.40	1.20	2.34	76.17	1.44	9.45	1.51	Do.
827	Hicks Prolific	do	Red	Hard	1882	3.419	8.15	1.85	2.20	76.64	1.53	9.63	1.54	Do.
1356	White Australian	do	do	Medium.	1879	3.653	11.15	1.70	2.02	72.48	2.50	10.15	1.62	Do.
	ALABAMA:													
1801	Lancaster Red	Winter	Red	Medium.	1883	3.930	11.18	2.37	1.64	70.70	1.51	12.60	2.02	Department of Agriculture.
1802	Smooth Mediterranean	do	do	do	1883	3.955	10.42	2.01	2.30	72.28	1.61	11.38	1.82	Do.
1803	Tuscan Island	do	do	do	1883	4.055	10.52	2.03	2.69	72.40	1.51	10.85	1.74	Do.
1804	Rogers Red	do	do	Soft	1883	2.011	9.36	2.17	2.50	73.24	1.88	10.85	1.74	Do.
1805	Dol	do	do	Medium.	1883	3.710	10.21	2.18	2.37	72.85	1.54	10.85	1.74	Do.
1806	Clawson	do	Amber	Hard	1883	2.242	9.81	2.09	1.94	74.37	1.81	9.98	1.60	Do.
1807	Rice	do	Red	Medium.	1883	3.731	10.78	2.02	2.42	71.67	1.56	11.55	1.85	Do.
1808	Bill Dallas	do	Amber	Hard	1883	4.647	11 03	1.77	2.01	73.72	1.32	10.15	1.62	Do.
1809	Tennessee, Amber	do	do	Medium.	1883	3.486	10 84	1.96	2.07	72.57	1.53	11.03	1.76	Do.
1810	Emporium	do	Red	do	1883	2.794	11.62	1.91	2.04	70.93	1.60	11.90	1.90	Do.
1811	Lovell's New	do	Amber	do	1883	2.183	11.57	2.19	2.28	72.42	1.74	9.80	1.57	Do.
1812	Washington Glass	do	White	do	1883	2.166	10.84	2.12	2.42	73.02	1.80	9.80	1.57	Do.
1813	Eureka	do	Amber	do	1883	2.675	11.43	1.96	2.09	71.49	1.65	11.38	1.82	Do.
1814	Purple Straw	do	Lt. Red	Hard	1883	2.823	12.12	1.94	2.40	68.99	1.77	12.78	2.04	Do.
1815	Kilpatric Rust Proof	do	Red	V. Hard.	1883	4.265	12.36	1.88	2.13	69.89	1.49	12.25	1.96	Do.
1816	Hughes Rust Proof	do	do	Hard	1883	3.594	12.18	1.90	2.07	68.52	1.68	13.65	2.18	Do.
1817	Red Mediterranean	do	do	do	1883	4.077	9.68	2.01	2.22	72.29	1.55	12.25	1.96	Do.
	OHIO:													
4	Swamp	Winter			1878	3.976	7.63	1.84	2.41	74.99	1.54	11.59	1.86	Department of Agriculture.
1827	Michigan amber	do	Red	Hard	1883	3.637	11.30	1.99	1.40	71.80	1.78	11.73	1.88	Do.
	INDIANA:													
1830	Osterey	Winter	Yellow	Hard	1883	2.768	10.16	2.05	1.51	73.41	2.02	10.85	1.74	Department of Agriculture.
	MICHIGAN:													
	White Extra	Winter			1877		12.75	1.56	1.26	70.96	1.83	11.64	1.87	Atwater.
	Diehl	do			1876		9.61	1.72		76.26		12.38	1.98	Kedzie.

	Diehl	do			1876		12.18	1.82		72.22		13.78	2.20	Kedzie.
	Do	do			1876		12.68	1.77		73.74		11.81	1.89	Do.
	Do	do			1876		10.25	1.50		76.37		11.88	1.90	Do.
	Soules	do			1876		10.02	1.73		75.44		11.81	1.89	Do.
	Do	do			1876		10.07	1.89		74.59		13.45	2.16	Do.
	Lincoln	do			1876		13.38	1.56		73.16		11.90	1.90	Do.
	Do	do			1876		10.78	1.75		76.09		11.38	1.82	Do.
	Fultz	do			1876		11.45	1.74		75.22		11.59	1.86	Do.
	Do	do			1876		12.53	1.74		71.26		14.47	2.31	Do.
	Treadwell	do			1876		12.69	1.71		73.10		12.50	2.00	Do.
	Do	do			1876		9.94	1.80		76.57		11.69	1.87	Do.
	Do	do			1876		10.00	1.76		76.36		11.88	1.90	Do.
	Buckeye	do			1876		12.73	1.38		74.92		10.97	1.75	Do.
	Tappahanock	do			1876		11.21	1.77		73.46		13.56	2.17	Do.
	Lancaster	do			1876		11.93	1.82		72.25		14.00	2.24	Do.
	Asiatic	do			1876		11.11	1.70		74.94		12.25	1.96	Do.
	Gold Medal	do			1876		10.55	1.73		76.57		11.15	1.78	Do.
	Do	do			1876		10.12	2.00		74.82		13.06	2.08	Do.
	Egyptian	do			1876		11.48	1.69		75.64		11.19	1.79	Do.
	Clawson	do			1876		12.29	1.64		74.19		11.88	1.90	Do.
	Do	do			1876		11.30	1.74		76.02		10.94	1.75	Do.
	Do	do			1876		12.29	1.79		74.76		11.16	1.78	Do.
	Do	do			1876		10.36	1.64		76.19		11.81	1.89	Do.
	Do	do			1876		11.19	1.76		74.99		12.06	1.93	Do.
	Do	do			1876		11.09	1.64		74.89		12.38	1.98	Do.
	Do	do			1876		11.08	1.49		75.18		12.25	1.96	Do.
	Do	do			1876		10.43	1.70		75.18		12.69	2.03	Do.
	Do	do			1876		10.31	1.60		75 84		12.25	1.96	Do.
	Do	do			1876		13.00	1.79		73.84		11.37	1.82	Do.
	Weeks	do			1876		10.03	1.59		77.38		11.00	1.76	Do.
	Powers	do			1876		10.85	1.70		75.42		12.03	1.92	Do.
	Armstrong	do			1876		12.21	1.97		72.94		12.88	2.06	Do.
	Tuscan	do			1876		13.77	1.72		73.14		11.37	1.82	Do.
	Post	do			1876		10.77	1.58		76.90		11.25	1.78	Do.
1293	Silver Chaff	do	White	Soft	1879	4.196	10.25	1.00	1.70	75.00	1.20	10.85	1.75	Department of Agriculture.
1294	Louisiana	do	do	Medium.	1879	3.738	10.30	1.60	2.07	73.73	1.80	10.50	1.68	Do.
1295	Jersey Red	do	Red	Hard	1879	3.981	9.05	1.70	2.17	73.17	2.18	11.73	1.88	Do.
1296	Powers	do	White	do	1879	3.611	9.70	1.05	1.79	75.91	1.05	10.50	1.68	Do.
1297	Dot	do	Red	do	1879	4.535	9.70	1.90	2.23	71.94	1.80	12.43	1.99	Do.
1298	Michigan Wick	do	White	Medium	1879	3.931	9.65	1.65	2.09	73.88	2.05	10.68	1.71	Do.
1299	Schaeffer	do	Yellow	Medium.	1879	4.269	9.35	1.65	2.12	73.80	1.88	11.20	1.79	Do.
1340	Lancaster Red	do	Red	Hard	1879	4.625	11.25	1.80	2.21	69.96	1.83	12.95	2.07	Do.
1341	Velvet Chaff	do	Yellow	do	1879	4.135	11.50	2.05	2.17	68.60	1.68	14.00	2.24	Do.
1342	Shumaker	do	Amber	do	1879	4.525	11.10	1.35	1.97	71.38	1.60	12.60	2.02	Do.
1343	Armstrong	do	Yellow	do	1879	3.983	10.60	1.70	2.30	72.62	2.10	10.68	1.71	Do.
1344	Muskingum	do	Red	Medium.	1879	4.010	11.35	1.40	2.16	70.59	1.90	12.60	2.02	Do.
1345	Mediterranean	do	do	do	1879	4.902	10.90	1.25	1.98	69.41	1.23	15.23	2.44	Do.
1346	Red Russian	do	do	Soft	1879	4.809	10.40	2.05	2.31	71.38	1.78	12.08	1.93	Do.
1347	Diehl	do	White	do	1879	3.402	10.90	1.75	2.14	73.11	1.60	10.50	1.68	Do.
1348	Clawson	do	Yellow	Medium.	1879	4.096	11.40	1.65	2.20	72.12	1.95	10.68	1.71	Do.
1349	Jennings	do	White	Soft	1879	3.926	11.65	1.85	1.99	70.61	1.65	12.25	1.96	Do.

ANALYSES OF AMERICAN WHEATS ARRANGED BY STATES—CONTINUED.

Serial number.	Name.	Spring or winter.	Color.	Consistency.	Year of growth.	Weight of 100 grains.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Analyst.
	MICHIGAN—Continued.					*Grams.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	Department of Agriculture.
1350	Buckeye	Winter	Yellow	Soft	1879	4.106	11.55	1.45	1.89	70.73	1.95	12.43	1.99	Do.
1351	Trump	do	do	do	1879	4.301	10.95	1.70	1.95	72.02	2.00	11.38	1.82	Do.
754	Shumaker	do	Amber	Hard	1882	4.377	10.05	2.08	2.45	74.01	2.28	9.13	1.46	Do.
755	Clawson	do	Yellow.	Medium.	1882	3.856	11.20	1.97	2.18	71.59	2.35	10.69	1.71	Do.
	KENTUCKY:													
1280	Fultz	Winter	Red	Hard	1882	3.666	10.55	1.40	2.30	71.87	1.98	11.90	1.90	Department of Agriculture.
1837	Rice	do	do	do	1883	3.465	10.53	1.79	1.99	69.55	1.61	14.53	2.32	Do.
1838	Do	do	do	do	1883	3.645	10.96	1.52	1.94	69.89	1.69	14.00	2.24	Do.
1910	Fultz	do	Amber	do	(?)	3.274	12.44	1.76	1.87	69.44	1.71	12.78	2.04	Do.
1913	Odessa	do	do	Soft	(?)	3.146	10.68	1.76	1.64	71.75	2.27	11.90	1.90	Do.
1916	German Amber	do	do	Medium.	(?)	3.539	9.86	1.78	1.79	69.95	2.44	14.18	2.27	Do.
1917	White	do	White	Soft	(?)	3.395	9.94	2.07	1.65	71.22	2.34	12.78	2.04	Do.
1919	Fultz	do	Amber	Medium.	(?)	3.502	11.68	1.88	1.80	69.26	2.25	13.13	2.10	Do.
	TENNESSEE:													
805	Swamp	Winter	Red	Hard	1881	3.669	7.10	2.10	2.08	70.24	1.85	16.63	2.66	Department of Agriculture.
775	Tennessee Amber	do	Amber	do	1882	3.204	9.90	1.85	2.09	72.78	1.48	11.90	1.90	Do.
776	Spark's Swamp	do	do	do	1882	3.551	10.24	1.80	2.31	72.37	1.73	11.55	1.85	Do.
1840	Rice	do	Red	do	1883	3.734	9.19	2.04	2.15	74.40	2.24	9.98	1.60	Do.
1824	White Mediterranean	do	White	Soft	1883	2.469	10.92	2.38	1.90	66.71	2.86	15.23	2.44	Do.
1843	Do	do	do	do	1883	2.138	10.64	2.10	2.04	72.87	2.20	10.15	1.62	Do.
775	Tennessee Amber	do	Amber	Medium.	1883	3.204	9.90	1.85	2.09	72.78	1.48	11.90	1.90	Do.
1909	Do	do	Yellow	Soft	(?)	2.448	11.10	1.62	2.06	70.95	1.67	12.60	2.02	Do.
1911	Red	do	Amber	Hard	(?)	2.568	11.85	1.90	2.00	71.57	1.83	10.85	1.74	Do.
1912	Bearded	do	do	Soft	(?)	3.326	11.30	1.90	2.12	69.71	2.54	12.43	1.99	Do.
1914	Fultz	do	do	Medium.	(?)	2.761	10.64	1.60	2.16	70.87	2.13	12.60	2.02	Do.
1915	Do	do	do	do	(?)	3.737	10.66	1.92	1.87	71.11	2.36	12.08	1.93	Do.
1918	California Gold Chaff	do	do	Hard	(?)	3.301	10.26	1.72	1.69	68.72	2.21	15.40	2.46	Do.
835	Swamp	do	do	do	1882	3.990	8.95	1.65	2.20	73.60	2.70	11.90	1.90	Do.
	DAKOTA:													
768	Castle Fife	Winter		Hard	1882	3.513	10.98	2.20	2.11	72.20	1.83	10.68	1.71	Department of Agriculture.
810	Scotch Fife	Spring		do	1882	2.755	10.08	1.80	2.25	69.69	1.83	14.35	2.30	Do.
	MINNESOTA:													
	Minnesota Fife, No. 1			Hard	1882	2.732	12.34	1.59			2.03	13.06	2.09	Noyes.
	Minnesota Fife, No. 2			do	1882	2.109	11.31	1.92			2.37	13.00	2.08	Do.
	Minnesota Fife, No. 3			do	1882	2.637	11.85	1.97			2.50	13.56	2.17	Do.
1900	Egyptian		Yellow	do	(?)	3.828	10.44	1.95	1.77	70.99	1.55	13.30	2.13	Department of Agriculture.

1901	Scotch Fife		Amber	Medium.	(?)	3.154	10.62	1.90	2.08	72.21	2.31	10.85	1.74	Do.
1902	Red Fern		...do	...do	(?)	3.192	11.74	1.91	2.16	64.84	2.20	17.15	2.74	Do.
1903	Fife		Yellow	Soft	(?)	3.046	10.31	1.79	2.16	69.37	2.89	13.48	2.16	Do.
1904	Old Settlers		Red	Medium.	(?)	3.364	10.10	1.57	1.83	72.26	1.81	12.43	1.99	Do.
1905	Red Fern		...do	...do	(?)	3.242	10.08	1.43	2.19	72.09	1.96	12.25	1.96	Do.
1906	Fife		Amber	Soft	(?)	3.116	11.34	1.50	2.02	71.77	1.82	11.55	1.85	Do.
1907	Golden Drop		...do	...do	(?)	3.545	11.10	1.53	1.89	71.97	1.96	11.55	1.85	Do.
1908	White Fife		White	Medium.	(?)	3.699	9.70	1.80	2.19	73.05	1.88	11.38	1.82	Do.
	MISSOURI:													
	Red	Winter	Red	Hard	(?)		13.52	1.55	1.47	69.95	1.72	11.79	1.89	Atwater.
3	Yellow	...do	Yellow	...do	1878	3.098	7.69	1.91	2.11	75.17	1.53	11.59	1.86	Department of Agriculture.
756	Fultz	...do	Red	...do	1879	3.455	10.28	1.80	2.28	72.86	2.28	10.50	1.68	Do.
757	Shumaker	...do	...do	...do	1879	3.349	8.64	1.99	2.33	72.11	2.49	12.44	1.99	Do.
758	Zimmerman	...do	...do	...do	1879	3.867	9.18	2.01	2.35	72.51	2.57	11.38	1.82	Do.
759	Clawson	...do	Amber	...do	1879	3.860	9.18	1.91	2.16	73.28	2.28	11.19	1.79	Do.
760	Russian, No. 2	...do	Yellow	...do	1879	3.475	8.43	2.09	2.23	73.53	2.72	11.00	1.76	Do.
761	Smooth Mediterranean	...do	Amber	...do	1879	3.583	9.45	1.89	1.80	72.43	2.68	11.75	1.88	Do.
762	Silver Chaff	...do	...do	...do	1879	3.492	10.99	2.22	2.42	70.89	2.29	11.19	1.79	Do.
778	Osterey	...do		...do	1882	3.340	11.48	1.90	2.36	70.95	1.88	11.43	1.92	Do.
1836	Rice	...do	Red	...do	1883		9.36	1.88	2.37	70.62	1.77	14.00	2.24	Do.
1835	Tennessee Amber	...do	Amber	...do	1883		9.41	1.88	2.35	74.01	1.85	10.50	1.68	Do.
	KANSAS:													
1935			White	Soft	(?)	3.424	11.58	1.72	1.98	71.87	2.01	10.85	1.74	Department of Agriculture.
1936			Red	Medium.	(?)	3.332	11.77	1.84	2.07	71.15	1.97	11.20	1.79	Do.
1937			White	Soft	(?)	3.349	11.60	1.78	2.04	72.19	1.89	10.50	1.68	Do.
1938			Red	Hard	(?)	2.995	11.36	1.54	1.91	70.18	2.76	12.25	1.96	Do.
1939			...do	Medium.	(?)	3.331	11.57	1.47	2.02	72.29	1.62	11.03	1.76	Do.
1940			...do	...do	(?)	3.405	12.38	1.58	1.83	71.96	1.75	10.50	1.68	Do.
1941			Amber	...do	(?)	2.975	12.27	1.61	2.01	70.12	2.09	11.90	1.90	Do.
1942			White	Soft	(?)	3.390	12.10	1.70	1.96	71.73	1.66	10.85	1.74	Do.
1943			Amber	Medium.	(?)	2.881	11.62	1.66	2.12	70.87	3.05	10.68	1.91	Do.
1944			Red	...do	(?)	2.956	11.76	1.50	1.83	71.15	2.03	11.73	1.88	Do.
	TEXAS:													
1920			Red	Medium.	(?)	2.606	10.64	1.92	2.39	70.23	2.39	12.43	1.99	Department of Agriculture.
1921			...do	Hard	(?)	2.663	9.70	1.66	2.56	71.14	1.99	12.95	2.07	Do.
1922			...do	...do	(?)	2.708	9.26	2.18	1.94	70.19	2.08	14.35	2.30	Do.
1923			...do	...do	(?)	2.826	9.36	1.64	2.15	70.95	2.25	13.65	2.18	Do.
1924			Amber	...do	(?)	2.699	9.50	1.60	2.00	73.86	2.01	11.03	1.76	Do.
1925			White	Soft	(?)	3.937	9.55	1.94	1.89	71.13	1.89	13.65	2.18	Do.
1926			Amber	...do	(?)	2.409	9.66	2.43	1.86	69.68	2.19	14.18	2.27	Do.
1927			...do	Hard	(?)	2.631	10.26	1.86	1.96	70.37	1.90	13.65	2.18	Do.
1928			Red	Medium.	(?)	2.690	10.24	1.72	1.76	71.46	2.22	12.60	2.02	Do.
1929			Amber	...do	(?)	2.608	10.00	1.52	1.92	70.55	2.01	14.00	2.24	Do.
1930			...do	Soft	(?)	2.714	9.62	1.68	1.72	70.79	2.19	14.00	2.24	Do.
1931	Nicaraguan		Yellow	...do	(?)	3.136	10.00	1.72	1.83	69.55	2.20	14.70	2.35	Do.
1932			White	...do	(?)	4.740	10.28	1.80	2.46	72.73	2.05	10.68	1.71	Do.
1933			Red	...do	(?)	2.622	10.04	1.76	2.46	70.95	2.19	12.60	2.02	Do.
1934			...do	Medium.	(?)	2.561	10.00	1.76	2.83	70.78	2.03	12.60	2.02	Do.
1819	Red Mediterranean	Winter	...do	Hard	1883	3.525	8.88	2.02	2.34	69.44	2.09	15.23	2.44	Do.
1826	Do	...do	...do	...do	1883	3.320	11.61	1.69	2.08	70.62	1.92	12.08	1.93	Do.
1825	White Mediterranean	...do	White	Soft	1883	3.700	12.05	2.02	1.59	68.95	1.91	13.48	2.16	Do.
1610	Nicaraguan	...do	Glassy	Hard	1882		9.94	1.58	2.29	72.75	1.71	11.73	1.88	Do.

Serial number.	Name.	Spring or winter.	Color.	Consistency.	Year of growth.	Weight of 100 grains.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Analyst.
	COLORADO:					*Grams.*	*Per ct.*	*Pr. ct.*	*Pr. ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	
719	Hybrid, No. 10	Winter	Amber	Hard	1881	.....	9.72	2.28	2.16	70.77	1.32	13.75	2.20	Department of Agriculture.
720	Hybrid, No. 15	do	Red	do	1881	.....	10.07	1.93	2.68	71.50	1.57	12.25	1.96	Do.
721	Hybrid, No. 16	do	do	Medium.	1881	4.824	9.53	2.04	2.54	72.52	1.62	11.75	1.88	Do.
722	Hybrid, No. 17	do	do	Hard	1881	5.137	9.93	2.07	3.93	68.86	1.59	13.62	2.18	Do.
723	Hybrid, No. 18	do	.....	.....	1881	.....	9.74	2.19	1.58	74.95	1.60	12.94	2.07	Do.
724	Hybrid, No. 19	do	.....	.....	1881	.....	10.45	2.54	2.19	70.59	1.79	12.44	1.99	Do.
725	Hybrid, No. 20	do	do	.....	1881	.....	10.57	3.57	2.32	69.62	1.67	12.25	1.96	Do.
726	New South Wales Seed	do	Yellow	Medium.	1881	4.657	9.47	2.18	2.40	71.78	1.55	12.62	2.02	Do.
727	Centennial	do	.....	.....	1881	.....	9.66	2.35	2.00	72.83	1.10	12.06	1.93	Do.
728	El Dorado	do	Yellow	Hard	1881	4.702	10.55	2.24	2.43	71.93	1.10	11.75	1.88	Do
729	White Mexican	do	.....	.....	1881	.....	9.91	2.60	1.89	70.27	1.52	13.81	2.21	Do.
730	Judkin	do	Red	Hard	1881	.....	9.75	2.57	2.42	71.31	1.70	12.25	1.96	Do.
731	Australian	do	Yellow	Soft	1881	5.506	9.78	1.85	2.23	73.50	1.45	11.19	1.79	Do.
732	Fountain	do	do	Hard	1881	5.100	10.58	2.70	2.15	69.63	1.32	13.62	2.18	Do.
733	Perfection	do	do	do	1881	5.536	9.93	1.99	2.32	70.03	1.55	14.18	2.27	Do.
734	Russian	do	Red	Soft	1881	4.131	9.55	1.99	2.62	69.86	1.49	14.49	2.31	Do.
735	Rio Grande	do	do	do	1881	5.906	9.54	2.08	2.96	68.97	1.79	14.69	2.35	Do.
736	Tousselle	do	Yellow	Medium.	1881	5.214	10.23	2.10	2.35	70.17	1.65	13.50	2.16	Do.
737	German Fife	do	Red	Soft	1881	5.368	10.42	2.31	2.79	67.94	1.48	15.06	2.41	Do.
738	Oregon Club	do	Yellow	do	1881	4.434	9.59	1.91	2.19	72.46	1.60	12.25	1.96	Do.
739	Sonora	do	do	do	1881	4.739	10.17	2.02	2.13	70.10	1.40	14.18	2.27	Do.
740	Imperial Fife	do	do	Hard	1881	4.147	9.48	2.64	2.31	68.00	1.63	15.94	2.55	Do.
741	Lost Nation	do	Red	Medium.	1881	3.851	10.24	2.17	2.99	69.93	1.74	12.93	2.07	Do.
742	Pringles, No. 6	do	Yellow	do	1881	5.145	9.89	2.13	2.52	70.63	1.70	13.13	2.10	Do.
743	Pringles, No. 7	do	Amber	Hard	1881	4.636	9.89	2.23	2.20	68.65	1.78	15.25	2.44	Do.
744	Clawson	do	Yellow	Soft	1881	4.565	10.14	1.94	2.31	72.26	1.60	11.75	1.88	Do.
745	Hedge Row	do	do	Medium.	1881	4.072	9.07	2.08	2.11	71.50	1.62	13.62	2.18	Do.
746	Do	Spring	Amber	Hard	1881	4.499	9.17	2.59	2.09	71.88	1.33	12.94	2.07	Do.
747	White Chaff	Winter	Red	Soft	1881	4.214	9.57	2.03	2.44	69.64	2.18	14.04	2.25	Do.
748	Triticum	do	Yellow	Hard	1881	5.754	10.02	2.67	2.65	69.53	1.51	13.62	2.18	Do.
749	Durum Russia	do	Amber	do	1881	5.924	9.91	2.32	2.00	68.98	1.54	15.25	2.44	Do.
750	Doty	do	Red	Soft	1881	4.373	9.41	2.35	2.50	69.94	1.80	14.00	2.24	Do.
751	Meekins	do	do	do	1881	5.193	9.38	2.53	2.97	68.38	1.59	15.15	2.43	Do.
786	McGehee's Red	do	do	Hard	1882	4.159	7.85	1.85	1.97	72.53	1.80	14.00	2.24	Do.
788	Finley	do	do	do	1882	4.125	9.30	1.85	2.36	72.16	1.73	12.60	2.02	Do.
790	Champion Amber	do	Amber	do	1882	4.347	8.20	2.21	2.47	73.68	1.55	11.90	1.90	Do.

792	Dallas	...do	Red	...do	1882	4.670	10.05	1.85	2.46	69.38	1.73	14.53	2.32	Do.
794	Bennet	...do	..do	...do	1882	3.976	7.85	2.20	2.58	71.67	2.05	13.65	2.18	Do.
796	Lemon	...do	...do	...do	1882	4.335	8.45	2.05	2.14	73.25	1.68	12.43	1.99	Do.
798	Gold Medal	...do	...do	...do	1882	4.375	9.25	1.80	2.26	72.71	1.73	12.25	1.96	Do.
800	German Amber	...do	Amber	Medium.	1882	4.027	8.80	1.80	2.42	72.80	1.75	12.43	1.99	Do.
802	Rice	...do	Red	Hard	1882	4.103	8.50	2.10	2.39	70.86	1.97	14.18	2.27	Do.
804	Washington Glass	...do	...do	..do	1882	4.450	8.60	1.95	2.41	74.31	1.18	11.55	1.85	Do.
806	Swamp	...do	...do	...do	1882	4.423	10.15	2.05	2.29	69.31	1.85	14.35	2.30	Do.
808	Wysor	...do	...do	...do	1882	4.609	8.55	2.25	2.20	72.27	2.13	12.60	2.02	Do.
	OREGON:													
	Clawson	Winter					12.99	1.77		74.74		10.50	1.68	Kedzie.
	Senora Club	(?)					10.91	1.46		77.00		10.63	1.70	Do.
10	White	Winter			1878		9.52	1.57	1.69	77.11	1.53	8.58	1.37	Department of Agriculture.
14	Chili Club	Spring			1878		7.90	1.56	2.33	78.66	1.41	8.14	1.30	Do.
15	Noah Island	..do			1878		9.64	2.00	2.06	75.18	1.92	9.20	1.47	Do.
772	Hudson Bay	Winter			1882	4.253	10.97	1.75	2.31	74.51	1.88	8.58	1.37	Do.
773	Velvet Chaff	...do	White		1882	5.144	10.92	1.95	1.80	75.60	1.68	8.05	1.29	Do.
774	Red Chaff	Spring	Red		1882	5.745	10.68	2.20	2.16	74.91	1.65	8.40	1.34	Do.
7	Foizy	Winter					8.98	1.73	2.28	77.36	1.25	8.40	1.34	Do.
8	Brazilian	...do					9.29	1.95	1.99	76.13	1.17	9.47	1.51	Do.
	BRITISH COLUMBIA:													
	Soules				1876		8.51	1.63		77.61		12.25	1.96	Kedzie.
	Do				1876		11.22	2.09		74.81		11.88	1.90	Do.

Exhibit of Saint Paul, Minneapolis and Manitoba Railroad.

Serial number.	Name.	Locality.	Color.	Consistency.	Weight of 100 grains.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.
					Grams.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1900	Egyptian		Yellow	Hard	3.828	10.44	1.95	1.77	70.99	1.55	13.30	2.13
1901	Scotch Fife		Amber	Medium	3.154	10.62	1.90	2.08	72.24	2.31	10.85	1.74
1902	Red Fern		do	do	3.192	11.74	1.91	2.16	64.84	2.20	17.15	2.74
1903	Fife		Yellow	Soft	3.046	10.31	1.79	2.16	69.37	2.89	13.48	2.16
1904	Old Settler		Red	Medium	3.364	10.10	1.57	1.83	72.26	1.81	12.43	1.99
1905	Red Fern		do	do	3.242	10.08	1.43	2.19	72.09	1.96	12.25	1.96
1906	Fife		Amber	Soft	3.116	11.34	1.50	2.02	71.77	1.82	11.55	1.85
1907	Golden Drop		do	do	3.545	11.10	1.53	1.89	71.97	1.96	11.55	1.85
1908	White Fife		White	Medium	3.699	9.70	1.80	2.19	73.05	1.88	11.38	1.82

Exhibit of Louisville and Nashville Railroad.

1909	Amber	Henry County, Tennessee	Yellow	Soft	2.948	11.10	1.62	2.06	70.95	1.67	12.60	2.02
1910	Fultz	Henderson County, Kentucky	Amber	Medium	3.274	12.44	1.76	1.87	69.44	1.71	12.78	2.04
1911	Red	Henry County, Tennessee	do	Hard	2.568	11.85	1.90	2.00	71.57	1.83	10.85	1.74
1912	Bearded	Carroll County, Tennessee	do	Soft	3.326	11.30	1.90	2.12	69.71	2.54	12.43	1.99
1913	Odessa	Kentucky	do	do	3.146	10.68	1.76	1.64	71.75	2.27	11.90	1.90
1914	Fultz	Montgomery County, Tennessee	do	Medium	2.761	10.64	1.60	2.16	70.87	2.13	12.60	2.02
1915	Do	Montgomery County, Tennessee	do	do	3.737	10.66	1.92	1.87	71.11	2.36	12.08	1.93
1916	German Amber	Kentucky	do	do	3.539	9.86	1.78	1.79	69.95	2.44	14.18	2.27
1917	White	Kentucky	White	Soft	3.395	9.94	2.07	1.65	71.22	2.34	12.78	2.04
1918	California Gold Chaff	Tennessee	Amber	Hard	3.301	10.26	1.72	1.69	68.72	2.21	15.40	2.46
1919	Fultz	Kentucky	do	Medium	3.502	11.68	1.88	1.80	69.26	2.25	13.13	2.10

Exhibit of Texas and Pacific Railroad.

1920		Comac County, Texas	Red	Medium	2.696	10.64	1.92	2.39	70.23	2.39	12.43	1.99
1921		Beaver County, Texas	do	Hard	2.663	9.70	1.66	2.56	71.14	1.99	12.95	2.07
1922		Traverse County, Texas	do	do	2.708	9.26	2.18	1.94	70.19	2.08	14.35	2.30
1923		Beaver County, Texas	do	do	2.826	9.36	1.64	2.85	70.95	2.25	13.65	2.18
1924		Williamson County, Texas	Amber	do	2.699	9.50	1.60	2.00	73.86	2.01	11.03	1.76

1925		El Paso County, Texas	White	Soft	3.937	9.50	1.94	1.89	71.13	1.89	13.65	2.18
1926		Williamson County, Texas	Amber	do	2.409	9.66	2.43	1.86	69.68	2.19	14.18	2.27
1927		Kaufman County, Texas	do	Hard	2.631	10.26	1.86	1.96	70.37	1.90	13.65	2.18
1928		Tarrant County, Texas	Red	Medium	2.690	10.24	1.72	1.76	71.46	2.22	12.60	2.02
1929		Traverse County, Texas	Amber	do	2.608	10.00	1.52	1.92	70.55	2.01	14.90	2.24
1930		Dallas County, Texas	do	Soft	2.714	9.62	1.68	1.72	70.79	2.19	14.00	2.24
1931	Nicaraguan	Milan County, Texas	Yellow	Hard	3.136	10.00	1.72	1.83	69.55	2.20	14.70	2.35
1932		El Paso County, Texas	White	Soft	4.740	10.28	1.80	2.46	72.73	2.05	10.68	1.71
1933		Tarrant County, Texas	Red	do	2.622	10.04	1.76	2.46	70.95	2.19	12.60	2.02
1934		Traverse County, Texas	do	Medium	2.561	10.00	1.76	2.83	70.78	2.03	12.60	2.02

Exhibit of Atchison, Topeka and Santa Fé Railroad.

1935			White	Soft	3.424	11,58	1.72	1.98	71.87	2.01	10.85	1.74
1936			Red	Medium	3.332	11.77	1.84	2.07	71.15	1.97	11.20	1.79
1937			White	Soft	3.349	11.60	1.78	2.04	72.19	1.89	10 50	1.68
1938			Red	Hard	2.995	11.36	1.54	1.91	70.18	2.76	12.25	1.96
1939			do	Medium	3.331	11.57	1.47	2.02	72.29	1.62	11.03	1.76
1940			do	do	3.405	12.38	1.58	1.83	71.96	1.75	10.50	1.68
1941			Amber	do	2.975	12.27	1.61	2.01	70.12	2.09	11.90	1.90
1942			White	Soft	3.390	12.10	1.70	1.96	71.73	1.66	10.85	1.74
1943			Amber	Medium	2.881	11.62	1.66	2.12	70.87	3.05	10.68	1.71
1944			Red	do	2.956	11.76	1.50	1.83	71.15	2.03	11.73	1.88

AVERAGES.

From the data contained in the previous tables, excluding the incomplete analyses of Kedzie and Noyes, a table of averages has been calculated, which includes—

1. The average composition of the wheats of America.
2. The average composition of the wheats of the Atlantic and Gulf States from Canada to Alabama, inclusive.
3. The average composition of the wheat of the Middle West limited by the Mississippi River.
4. The average composition of the wheats of the West beyond the Mississippi, including Texas, Colorado, Kansas, Missouri, and Minnesota.
5. The average composition of the wheats of the Pacific slope, unfortunately only represented by eight samples from Oregon.
6. The average composition of the wheats grown in each of the States where as many as six specimens have been analyzed.

No. of analyses.		Weight of 100 grains.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Heaviest 100 grains.	Lightest 100 grains.	Highest albuminoids.	Lowest albuminoids.
		Grams.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Grams.*	*Grams.*	*Per ct.*	*Per ct.*
260	United States and Canada	3.638	10.27	1.84	2.16	71.98	1.80	11.95	1.91	5.924	1.830	17.15	8.05
108	Atlantic and Gulf States	3.464	10.42	1.75	2.17	72.61	1.72	11.33	1.81	5.079	1.830	15.58	9.45
47	The Middle West	3.607	10.51	1.76	2.01	71.67	1.90	12.15	1.94	4.902	2.138	16.63	10.15
97	West of the Mississippi	3.806	10.04	1.99	2.22	71.12	1 87	12.76	2 04	5.924	2.561	17.15	10.15
8	The Pacific coast	5.044	9.74	1.84	2.08	76.18	1.56	8.60	1.37	(5.745)	(4.253)	9.47	8.05
6	Canada	3.325	9.74	1.56	2.29	73.87	1.67	10.87	1.74	3.686	2.964	14.70	9.45
32	Pennsylvania	3.373	10.72	1.67	2.05	72.45	1.73	11.38	1.82	4.658	2.035	15.58	9.45
9	Maryland	3.597	10.52	1.75	2.09	72.25	1.74	11.65	1.86	5.079	3.075	14.53	9.80
11	Virginia	3.343	10.34	1.70	2.21	71.87	1.71	12.71	1.95	4.208	1.830	14.00	10.15
7	Georgia	3.579	10.00	1.96	2.30	72.24	1.72	11.78	1.89	4.627	2.834	14.00	9.45
22	North Carolina	3.776	10.03	1.59	2.25	73.94	1.76	10.43	1.67	4.628	2.780	12.43	8.93
17	Alabama	3.314	10.94	2.03	2.21	71.84	1.62	11.36	1.79	4.647	2.011	13.65	9.80
	Michigan (Kedzie)	.....	11.28	1.73		74.97		12.02	1.92	.....	.....	13.78	9.13
22	Michigan	3.969	10.71	1.64	2.06	72.12	1.80	11.67	1.87	4.902	3.402	15.23	10.50
8	Kentucky	3.454	10.83	1.75	1.87	70.37	2.03	13.15	2.10	3.666	3.146	14.53	11 90
14	Tennessee	3.150	10.19	1.89	2.00	71.33	2.02	12.51	2.00	3.990	2.138	16.63	10.15
12	Missouri	3.502	9.80	1.92	2.19	72.36	2.17	11.56	1.86	3.867	3.098	14.00	10.50
9	Minnesota	3.354	10.60	1.71	2.03	70.96	2.04	12.66	2.03	3.828	3.116	17.15	10.85
10	Kansas	3.204	11.80	1.64	1.98	71.35	2.08	11.15	1.78	3.424	2.881	12.25	10.50
19	Texas	2.847	10.03	1.81	2.11	70.85	2.06	13.14	2.10	3.937	2.561	15.23	10.68
45	Colorado	4.682	9.57	2.21	2.38	70.91	1.62	13.31	2.13	5.924	3.851	15.94	11.19
8	Oregon	5.044	9.74	1.84	2.08	76.18	1.56	8.60	1.37	5.745	4.253	9.47	8.05

The question arises at once as to whether the average American wheat can compare with that produced in foreign countries. The analyses of foreign wheats have been collected and averaged by several continental investigators, and their results furnish us with a means for making the comparison.

AVERAGE COMPOSITION OF FOREIGN WHEATS.

Locality.	Authority.	No. of analyses.	Water.	Ash.
			Per cent.	*Per cent.*
Russian	Laskowsky	24	11.49	.....
German	Wolff	.....	14.40	1.70
Continental	Peligot	14	14.00	1.60
Do	Millon	16	13.82	1.57
Do	Reiset	20	14.43	1.99
World	König	200	13.56	1.79
Do	Kühn	.....	14.30	1.70

Locality.	Authority.	Oil.	Carbhydrates.	Fiber.
		Per cent.	*Per cent.*	*Per cent.*
Russian	Laskowsky	1.57	.....	.....
German	Wolff	1.50	66.40	3.00
Continental	Peligot	1.20	66.90	1.70
Do	Millon	1.74	70.13	1.70
Do	Reiset	.....	70.58	.....
World	König	1.70	67.87	2.66
Do	Kühn	1.60	66.20	3.00

Locality.	Authority.	Albuminoids.	Highest albuminoids.	Lowest albuminoids.
		Per cent.	*Per cent.*	*Per cent.*
Russian	Laskowsky	19.48	24.56	10.68
German	Wolff	13.00	.....	.....
Continental	Peligot	14.60	21.50	10.60
Do	Millon	11.04	13.81	9.92
Do	Reiset	13.00	17.94	10.69
World	König	12.42	24.16	8.19
Do	Kühn	13.20	24.10	8.20

At a glance it is apparent that the main failing of our wheats is their deficiency in albuminoids. In other regards they seem to be a degree lighter per hundred grains; they contain less water and about the same ash, more oil and a smaller amount of fiber. The variation in some of the constituents is quite large and should be taken into consideration with the averages. In the 260 wheats which I have examined, the following are the highest and lowest determinations made:

Limits and variation in the percentages of the constituents of wheats, and in the weight of 100 grains.

Constituents.	Highest percentage.	Lowest percentage.	Variation.	Above average.	Below average.
Water	12.44	7.85	4.59	2.02	2.57
Ash	3.57	.80	2.77	1.82	.95
Oil	3.93	1.40	2.53	1.76	.77
Carbhydrates	78.66	64.84	13.82	6.68	7.14
Fiber	3.05	.44	2.61	1.25	1.36
Albuminoids	17.15	8.05	9.10	5.20	3.90
Weight of 100 grains ..... grams	5.924	1.830	4.094	2.286	1.808

The extremes here given are due in no case, with the exception, perhaps, of the lowest water, to errors in analysis. All the determinations on which the table is based have been repeated in duplicate and verified, and the figures, without doubt, exhibit about the extremes which one may expect to find in any equal number of wheats.

Ash, oil, and albuminoids have the most striking variations, and it will be observed that they never will fall as far below the average in amount as at times they rise above it. In proportion to their importance and amount, the extent of variation of the albuminoids forms the most remarkable feature of the wheat grain. In our wheats, however, it is not so great as has been found in those of other countries, as may be seen in the following table:

Maxima and minima of albuminoids, percentage of nitrogen, and weight of 100 grains of wheat.

No. of analyses.	Locality.	Authority.	Per cent. of nitrogen.	Per cent. of Albuminoids.	Albuminoids.		Weight of 100 grains.		
					Maximum.	Minimum.	Average.	Maximum.	Minimum.
					Pr cent.	*Pr cent.*	*Grams.*	*Grams.*	*Grams.*
25	North German	Von Bibra	2.20	13.76	18.25	9.80	4.270	7.450	3.200
20	South German	do	2.13	13.28	17.81	9.68	4.473	7.000	2.875
14	Scotch	do	2.07	12.95	14.63	11.06	4.679	5.200	3.850
5	Egypt	do	1.46	9.10	9.94	8.75			
2	Australian	do	1.60	9.98	9.98	9.94			
13	Algerian	do	2.20	13.75	15.50	11.25	5.540	6.525	4.600
9	Spanish	do	2.30	14.35	24.13	11.25	4.278	5.125	3.850
7	Russian	do	2.45	15.31	21.70	10.44	3.950	5.350	1.800
24	Do	Laskowsky	3.13	19.48	24.16	10.68			
....	England	Lawes & Gilbert	2.20	13.76	15.50	11.25			
....	Germany	Mayer	2.20	13.75					
....	Do	Wolff	2.08	13.00					
15	Continental	Millon	1.88	11.75	12.63	9.88			
12	Do	Peligot	2.23	13.97	21.50	9.90			
20	Do	Reiset	2.04	12.78	17.90	10.68			
176	Average, excluding Russia	König	1.98	12.35	21.37	7.61			
....	Average of world	Kühn	2.11	13.20	24.10	8.20			

While among our wheats the highest percentage of albuminoids was found to be 17.15 in a wheat from Minnesota, Russian grain has been analyzed by Laskowsky which contained 24.56 per cent., twenty-four different specimens averaging 19.48 per cent., the lowest having 10.68 per cent. of albuminoids. The range is by these analyses largely extended, and if the wheats of all countries are taken into consideration it rises to 19.23 per cent., and the great susceptibility of wheat in this direction is made manifest. As the albuminoids are regarded, and probably rightly, as the most valuable part of the grain when properly elaborated, the effect of environment on this constituent will be one of the most important considerations in the study of the American grain, after its comparison with the foreign article has been completed in regard to the less important constituents. It is difficult to say for what reason our wheats contain so much less water than is given in the foreign averages quoted. We have never seen a sample which contained as much even as the average of Wolff for German wheat, and are aware

of only one analysis made in this country, and that by Jordan of a Pennsylvania wheat grown by himself, which exceeded 13 per cent. At times it seemed that it might be due to a drying out of the small specimens which were furnished us, and again to method of preparation for analysis, but neither explanation has been found to be correct, and it must be considered as some inherent peculiarity of our wheats which is due perhaps to our hotter and drier summer weather. When we come to consider the wheats of the different sections of the country it will be seen that the variation due to locality is imperceptible, but this again may be owing to the manner of preservation and preparation of the samples in our laboratory.

In oil our averages are hardly comparable as the larger amount found may be due to more thorough methods of extraction than were employed in the older analyses of foreign investigators before the continuous percolation apparatus was brought into use.

In ash the averages are quite alike, but it will be seen that in some portions of the United States, on new and rich soil, this constituent is much increased.

The amount of fiber present in our wheats is decidedly smaller as was found in a previous investigation to be the case in a large number of grasses when compared with continental varieties. A decrease in the albuminoids seems to be often accompanied by a decrease in fiber. It was found to be so in oat straw and grain by Beseler and Maercker in an investigation of that plant which they have recently published. How large an effect the changes in the small amount of fiber present in the grain may have on its milling properties it is not possible to say, but it is not probable that it is directly proportional to the percentage.

The average weight of one hundred grains is considerably smaller in this country than abroad, but allowance must be made for the averages which I have collected for foreign countries, as they are comparatively few in number and perhaps from selected samples, while the averages for our own wheat include all sizes grown under all conditions. The importance of this determination cannot be too strongly insisted upon as the confusion which may arise from mere chemical analyses without some knowledge of the physical properties of the grain will be shown in some analyses given in a later portion of this paper.

As has been shown, our average American wheat does not equal the average foreign wheat in albuminoids, except those from Egypt and Australia, but the averages for these localities are derived from too few data to be depended on. In studying the wheats of this country, however, according to the different portions of it from which they come, it becomes apparent that the averages for these localities differ from the general average of the whole country in a marked degree. The averages which were described for the Atlantic and Gulf States, for the Middle West, and for the West, and for the Pacific Coast, show that in the East our wheat is the poorest in the land, falling below the gen-

eral average in albuminoids and ash, and in the size of the grain. A regular gradation of improvement from East to West, however, is found in examining the other averages, until the Pacific coast is reached, where there is a most remarkable falling off in everything but the size of the grain. It is in the country between the Mississippi and the mountains that the best grain is produced. It has a higher average ash and a larger average amount of oil and albuminoids than that of any other part of the country, and it will be noticed that the highest extremes for ash, oil, albuminoids, and for weight of 100 grains are also found in this region. The Middle West, represented by Michigan, Kentucky, and Tennessee, holds an intermediate position between this district and that on the Atlantic coast. The latter shows plainly that its soils have become more or less worn out, the Middle West that it is losing its fertility, and the far West the fact that it contains those stores of plant food, and nitrogen especially, which make a rich grain of wheat. Why nothing better has been done in the way of production than a percentage of albuminoids as high as 17.15 is difficult to say, but the conditions undoubtedly do not equal those to be found in Russia.

The regular increase in the size or rather weight of 100 grains from the Atlantic to the Pacific is undoubtedly due to the greater amount of plant food supplied as we go westward; but we are again surrounded with difficulties when, the weight remaining large, an attempt is made to explain the great falling off in nitrogen in the Pacific coast wheats. It merely makes more prominent the peculiar susceptibility of this grain to its surroundings, and the fact that the largest grain and crops can be produced where there is an inability to assimilate nitrogen or a lack of nitrogen to be assimilated. The wheats of California have not yet been examined, but from what it has been possible to learn we understand that they are as fair in appearance as those of Oregon, but of poor milling qualities, which would point to a low percentage of albuminoids.

In 1878 a number of spring wheats were analyzed at the Department, and it was found that they contained much more nitrogen than ordinary winter varieties grown under the same conditions, with the exception of the spring wheats from Oregon. There they had been unable, even as spring wheat, to assimilate an average amount of nitrogen. The analyses are quoted:

Locality.	Albuminoids in—	
	Winter wheat.	Spring wheat.
	Per cent.	*Per cent.*
Canada	9.45	.....
Canada	9.89	14.70
New York	.....	15.40
New York	.....	14.00
Ohio	11.59	.....
Oregon	8.40	8.14
Oregon	9.45	9.80

These figures, together with other analyses of Oregon wheats, seem to warrant the conclusion that it is a peculiarity of Oregon and proba-

bly California wheat to contain a comparatively low amount of albuminoids, although the grain is large and handsome.

The other States, considered individually, appear to vary very much as wheat producers, even in relation to their own sections; that is to say, no one of the sections of the country which I have selected produces wheats of similar composition in its several states. The Atlantic States are more nearly uniform in this respect. Virginia apparently produces the finest wheat, but it must be said in explanation that the eleven samples from this State were not of such a nature, as may be seen from their description, as to represent its average production. It is a fact, however, that the Maryland and Virginia wheats bring a somewhat higher price in the Baltimore markets than any from other sections of the country. The samples from North Carolina are the lowest in percentage of albuminoids, but they were all fine-looking grain, and of larger average size than any I have seen from the East. The variation in the averages is not large, nor does it furnish us with any evidence that latitude has any effect upon the composition of the grain. The middle portion of the section produces a slightly better wheat, in fact is more of a wheat-growing country, and with the rational method of cultivation and fertilization which are rapidly becoming known and put in practice it will undoubtedly improve its average.

The middle, west, or central portion of our country is represented by averages for Michigan, Kentucky, and Tennessee, among which Kentucky easily holds the supremacy, if the eight wheats from various parts of the State actually furnish an average to be depended on. The samples from both Kentucky and Tennessee were mostly collected by the Louisville and Nashville Railroad, and were no doubt as good as could be found; but since no wheat among twenty-two has fallen below 10 per cent. of albuminoids, the States may be regarded as producing a good grain for this country which in one State averages 13.15 and in the other 12.51 per cent. of albuminoids.

After crossing the Mississippi the averages show that in Missouri and Kansas wheats are deficient in nitrogen, while Texas produces a grain rich in nitrogen but injured by too small weight per hundred. Minnesota has a much larger grain, not quite as well supplied with nitrogen. It is Colorado which leads our country in the production of a large grain, containing a large amount of albuminoids. This State shows what the possibilities are of raising a perfect wheat, and the conditions which must be taken into consideration. Perhaps Texas, with the same care, would produce as fine a wheat, and the same may be said of Minnesota. The conditions, in addition to soil and climate, which have been observed in Colorado, and some of which are certainly too much neglected elsewhere, are careful selections of the seed as to quality, sources, and avoidance of contamination and reversion, careful cultivation, irrigation where necessary, and, most of all, close observation. These conditions have been strictly attended to in the case of the Colorado wheats. The same care would have undoubtedly improved the wheat in other locali-

ties. In Texas, for instance, the seed has probably been of poorer quality, the cultivation less careful, and the necessary water supply lacking.

The wheats from Colorado which have been analyzed were from the experimental farm of the Colorado Agricultural College, at Fort Collins, on the Caché la Poudre River, where the soil is alluvial, containing plenty of lime from the neighboring cretaceous shales. They were grown under the direction of Prof. A. E. Blount, who has done much in the past few years to improve the varieties of wheat which have come into his hands by careful selection, hybridization, and continuous cultivation on the rich soils of Colorado. Of his experiments and their results in 1881 he says, alluding to the wheats which were analyzed:

These hybrids (see analyses of Colorado wheats) are but two years old, and hence have not become fixed. I crossed them in order to make the offspring better in quality and quantity for both farmer and miller. The objects attained by crossing wheats, or hybridization, as it is improperly called, are manifold. It improves the plant in various ways. It makes it more vigorous, less liable to the attacks of vegetable parasites; the straw is stiffer, better glazed and more healthy, the leaves better feeders as well as the roots; the glumes are more compact and better filled; the heads longer, and fertilization takes place more surely and successfully. Secondly, it improves the grain; makes it more plump, heavier, harder; consequently better suited to milling purposes; the bran is made thinner, more free from fluff and cellulose, the two obstacles which interfere so materially with milling; the grain is entirely transformed, being made to contain more or less gluten, starch, and other elements that make good flour.

The whole operation is very similar to breeding stock. The experimenter must thoroughly understand the entire vegetable and physiological structure of both wheats before he can make a cross with improvement on either parent.

WHEATS FROM COLORADO.

	Blount's Hybrid, No. 10.	720. Blount's Hybrid, No. 15.	721. Blount's Hybrid, No. 16, select.	722. Blount's Hybrid, No. 17.	723. Blount's Hybrid, No. 18.	724. Blount's Hybrid, No. 19, select.	725. Blount's Hybrid, No. 20.	726. Seed from New South Wales.	727. Centennial.
Color	Amber	Red.	Red.	Red	.....	.....	.....	Yellow	.....
Hardness	Hard	.....	Soft.	Hard.	.....	.....	.....	Hard	.....
Weight of 100 grains	.....	.....	4.824	5.137	.....	.....	.....	4.657	.....
Specific gravity	1.397	.....	1.331	1.308	.....	.....	.....	1.255	.....
Fresh gluten	42.22	32.24	52.92	34.16	32.22	36.96	35.22	28.31	23.80
Dry gluten	14.44	11.38	11.19	11.88	10.74	12.14	11.74	10.64	9.22
Total nitrogen	2.20	1.96	1.88	2.18	2.07	1.99	1.96	2.02	1.93
Moisture	9.72	10.07	9.53	9.93	9.74	10.45	10.57	9.47	9.66
Ash	2.28	1.93	2.04	2.07	2.19	2.54	3.57	2.18	2.35
Fat	2.16	2.68	2.54	3 93	1.58	2.19	2.32	2.40	2.00
Sugar, &c	4.12	2.92	3.38	4.20	3.32	3.44	3.64	4.22	3.06
Dextrine, &c	2.22	2.46	1.90	9.00	1.49	2.68	2.66	3.08	2.10
Starch, &c	61.10	66.12	67.24	53.66	67.23	64.47	63.32	64.68	67.67
Albuminoids, soluble in 80% alcohol	4.30	3.18	4.26	.80	3.57	3.28	3.71	5.05	4.26
Albuminoids, insoluble in 80% alcohol	9.60	9.06	7.49	12.82	9.37	9.10	8.54	7.57	7.80
Crude fiber	1.32	1.57	1.62	1.59	1.60	1.79	1.67	1.55	1.10
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total nitrogen × 6.25	13.75	12.25	11.75	13.62	12.94	12.44	12.25	12.62	12.06

WHEATS FROM COLORADO—Continued.

	728. El Dorado.	729. White Mexican.	730. Judkin.	731. Australian Club.	732. Fountain.	733. Perfection.	734. Russian.	735. Rio Grande.
Color	Yellow	Yellow	Red...	Amber	Yellow	Yellow	Red...	Red...
Hardness	Hard..	Soft...	.....	Hard..	Hard..	Hard..	Soft...	Soft...
Weight of 100 grains	4.702	.....	.....	5.506	5.100	5.536	4.131	5.906
Specific gravity	1.242	.....	.....	1.305	1.306	1.330	1.311	1.310
Fresh gluten	25.06	42.21	33.59	25.23	35.15	35.36	32.41	35.01
Dry gluten	9.49	14.33	12.10	8.91	11.93	12.07	12.13	12.34
Total nitrogen	1.88	2.21	1.96	1.79	2.18	2.27	2.32	2.35
Moisture	10.55	9.91	9.75	9.78	10.58	9.93	9.55	9.51
Ash	2.24	2.60	2.57	1.85	2.70	1.99	1.99	2.08
Fat	2.43	1.89	2.42	2.23	2.15	2.32	2.62	2.96
Sugar, &c	3.28	3.46	4.96	3.30	2.86	2.84	3.70	2.86
Dextrine, &c	1.82	2.20	2.80	1.92	2.32	1.80	2.20	2.58
Starch, &c	66.83	64.61	63.55	68.28	64.36	65.39	63.96	63.53
Albuminoids, soluble in 80% alcohol	3.83	4.20	1.97	3.01	3.53	4.34	3.81	3.19
Albuminoids, insoluble in 80% alcohol	7.92	9.61	10.28	8.18	10.29	9.84	10.68	11.50
Crude fiber	1.10	1.52	1.70	1.45	1.32	1.55	1.49	1.79
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total nitrogen × 6.25	11.75	13.81	12.25	11.19	13.62	14.18	14.49	14.69

	736. Touzelle.	737. German Fife.	738. Oregon Club.	739. Sonora.	740. Imperial Fife.	741. Lost Nation.	742. Pringle's No. 6.	743. Pringle's No. 7.
Color	Yellow	Red...	Yellow	Yellow	Yellow	Red...	Yellow	Med'm
Hardness	Med'm	Soft...	Soft...	Soft...	Hard..	Soft...	Med'm	Hard..
Weight of 100 grains	5.214	5.368	4.434	4.739	4.147	3.851	5.145	4.636
Specific gravity	1.301	1.283	1.326	1.344	1.325	1.323	1.304	1.347
Fresh gluten	33.25	38.33	28.92	34.86	39.47	29.52	34.78	33.69
Dry gluten	10.90	14.45	10.06	11.80	14.23	11.23	11.83	12.01
Total nitrogen	2.16	2.41	1.96	2.27	2.55	2.07	2.10	2.49
Moisture	10.23	10.42	9.59	10.17	9.43	10.24	9.89	9.89
Ash	2.10	2.31	1.91	2.02	2.64	2.17	2.13	2.23
Fat	2.35	2.79	2.19	2.13	2.31	2.99	2.52	2.20
Sugar, &c	3.24	2.02	3.10	3.18	4.04	3.52	3.52	2.94
Dextrine, &c	1.88	1.50	1.50	3.00	2.06	2.40	2.20	2.06
Starch, &c	65.05	63.42	67.86	63.92	61.95	64.01	65.85	63.68
Albuminoids, soluble in 80% alcohol	4.01	4.24	4.34	6.51	5.96	1.64	5.25	3.40
Albuminoids, insoluble in 80% alcohol	9.49	10.82	7.91	12.67	9.98	11.29	7.88	11.85
Crude fiber	1.65	1.48	1.60	1.40	1.63	1.74	1.70	1.78
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total nitrogen × 6.25	13.50	15.06	12.25	14.18	15.94	12.93	13.13	15.25

WHEATS FROM COLORADO—Continued.

	744. Clawson.	745. Hedge Row (winter crop).	746. Hedge Row (spr'g crop).	747. White Chaff.	748. Triticum.	749. Durum Russian.	750. Doty.	751. Meekins.
Color	Yellow	Yellow	Amber	Red...	Yellow	Med'm	Red...	Red...
Hardness	Soft...	Med'm	Hard..	Soft...	Hard..	Hard..	Soft...	Soft...
Weight of 100 grains	4.565	4.072	4.499	4.214	5.754	5.924	4.373	5.193
Specific gravity	1.289	1.357	1.338	1.233	1.315	1.326	1.284	1.293
Fresh gluten	26.91	34.01	30.14	32.44	34.32	37.54	35.81	38.61
Dry gluten	9.99	12.11	10.69	11.37	13.08	13.51	12.52	13.83
Total nitrogen	1.88	2.18	2.07	2.24	2.18	2.44	2.24	2.44
Moisture	10.14	9.07	9.17	9.57	10.02	9.91	9.41	9.38
Ash	1.94	2.08	2.59	2.13	2.67	2.32	2.35	2.53
Fat	2.31	2.11	2.09	2.44	2.65	2.00	2.50	2.97
Sugar, &c	4.10	2.80	3.12	4.80	4.60	4.28	3.68	5.12
Dextrine, &c	2.30	2.02	2.10	2.00	2.84	3.00	2.32	2.04
Starch, &c	65.86	66.68	66.66	62.88	62.09	61.30	63.94	61.17
Albuminoids, soluble in 80% alcohol	3.44	4.66	4.19	4.89	5.65	6.48	5.69	5.36
Albuminoids, insoluble in 80% alcohol.	8.31	8.96	8.75	9.11	7.97	8.77	8.31	9.89
Crude fiber	1.60	1.62	1.33	2.18	1.51	1.54	1.80	1.59
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total nitrogen × 6.25	11.75	13.62	12.94	14.00	13.62	15.25	14.00	15.15

An examination of the tables of analyses will show successes and failures in my work. A success cannot always be made in the first trial or the second. The experimenter is compelled to cross and recross sometimes in order to make a wheat that will suit both farmer and miller. Take Hybrid No. 18 for example. It is a failure so far as being fit for the mill is concerned. Why? Because the percentage of gluten, 10.74, is very much less than that of its mother. Improved Fife, 14.23, and but little, very little higher than that of its father, Australian Club, 8. 91. Had it been 11.57 or the average of both or more, there might have been a chance of making it a success. One more trial (the third) will settle the question whether or not it is worthy to be placed among the standards. How far it is a success or failure for the farmer remains to be determined.

Many wheats are splendid in the field and of no account in the mill and *vice versa*.

Please notice No. 19 in the table. The father wheat, Improved Fife, contains 14.23 per cent. of gluten; the mother, Oregon Club, 10.06 per cent.; average, 12.14 per cent.—exactly the per cent. that No. 19 contains. Now both these parent wheats were good for both farmer and miller, and I have reason to conclude that this offspring will be better than either parent when it is fixed. It is now only two years old, and will not become fixed or a standard until next year.

The above gives an idea of Professor Blount's method of working, and the analyses, which were made in more detail than usual, are represented to show his results. The parents of the different hybrids are given in the descriptions of the wheats under their serial numbers in the first part of this report. The first wheat, in all cases, is the father.

The effect upon the yield of the different varieties of a few years' growth upon Colorado soil is very marked.

For the samples of 1881 which were analyzed Professor Blount gives the following data:

Yield from one grain of different varieties of wheat introduced into Colorado.

Variety.	Fold first year.	Fold second year.	Fold third year.
Black Bearded Centennial			203
Judkin			320
Australian Club			416
White Fountain	440		
Russian	76	172	448
Touzelle	56	128	480
German Fife	112		
Oregon Club			480
Sonora	56	110	448
Improved Fife	56	126	416
Lost Nation	76	96	352
Clawson	68	136	544

All these wheats have been improved in this remarkable manner by selection, cultivation, and irrigation.

The average composition of the thirty-three varieties grown in 1881 is:

Weight of 100 grains	grams	4.865
Water	per cent	9.86
Ash	do	2.28
Oil	do	2.41
Carbhydrates	do	70.48
Crude fiber	do	1.57
Albuminoids	do	13.40
		100.00
Nitrogen		2.14

which is better than the averages for foreign grain, with the exception of Russia, but if the six wheats from that source are averaged by themselves they prove to be much superior to the remaining varieties.

Colorado wheats from Russian seed—1881.

Weight of 100 grains	grams	5.075
Water	per cent	9.69
Ash	do	2.41
Oil	do	2.44
Carbhydrates	do	69.49
Crude fiber	do	1.59
Albuminoids	do	14.54
		100.00
Nitrogen		2.32

and the same holds good when all the wheats whose seed had been obtained from foreign sources, except Australia, are averaged.

Colorado wheat from foreign seed—1881.

Weight of 100 grains	grams	5.187
Water	per cent	9.86
Ash	do	2.32
Oil	do	2.45
Carbhydrates	do	69.46
Crude fiber	do	1.57
Albuminoids	do	14.34
		100.00
Nitrogen		2.29

The remaining wheats from American seed, or seed which was not received direct from foreign sources or which came from Australia, give a correspondingly low average, showing that the tendency of foreign seed was to produce a better grain than domestic seed.

Average of Colorado wheat from domestic seed.—1881.

Weight of 100 grains	grams	4.714
Water	per cent	9.85
Ash	do	2.27
Oil	do	2.38
Carbhydrates	do	70.87
Crude fiber	do	1.58
Albuminoids	do	13.05
		100.00
Nitrogen		2.09

The superiority of the crops from foreign seed is marked.

The analyses which have just been discussed were of wheats of the harvest in 1881. In the autumn of that year thirteen selected seed wheats were sent to Professor Blount by the Department, and after harvest a portion of the seed furnished, and of the crop, was returned for inspection and analysis. To the eye alone they had all improved in appearance, and as a whole their average composition was very close to the average of the domestic varieties grown in 1881, as is seen by comparison.

Average composition of wheats from American seed, Colorado, 1881 *and* 1882.

		1881.	1882.
Number of analysis		24	12
Weight of 100 grains	grams	4.714	4.682
Water	per cent	9.85	8.80
Ash	do	2.27	1.99
Oil	do	2.39	2.38
Carbhydrates	do	70.87	72.08
Crude fiber	do	1.58	1.76
Albuminoids	do	13.04	13.04
		100.00	100.00
Nitrogen		2.09	2.09

The albuminoids are exactly the same both years, showing that the seasons which were somewhat different had not had a marked effect in this direction.

The changes which took place during one year's growth on Colorado soil of these seed is shown on a table which has been prepared with all the analyses calculated to a common basis of 10 per cent. of water.

COMPARISON OF DEPARTMENT SEED AND COLORADO CROP.

Variety.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Weight of 100 grains.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Grams.*
McGehee's Red:							
Department	10.00	1.04	2.46	71.57	1.46	13.47	2.811
Colorado	10.00	1.80	1.92	70.85	1.76	13.67	4.159
Finlay:							
Department	10.00	1.59	2.37	73.22	1.17	11.65	3.285
Colorado	10.00	1.83	2.34	71.60	1.72	12.51	4.125
Champ. Amber:							
Department	10.00	1.88	2.19	73.70	1.33	10.90	3.278
Colorado	10.00	2.16	2.42	72.24	1.52	11.66	4.347
Dallas:							
Department	10.00	2.10	2.43	71.54	1.61	12.32	4.023
Colorado	10.00	1.85	2.46	69.34	1.73	14.52	4.610
Bennett:							
Department	10.00	2.01	2.17	70.77	1.35	13.70	3.218
Colorado	10.00	2.15	2.52	70.00	2.00	13.33	3.976
Lemon:							
Department	10.00	1.87	2.46	68.87	1.50	15.30	3.417
Colorado	10.00	2.02	2.10	72.01	1.65	12.22	4.335
Gold Medal:							
Department	10.00	1.77	2.33	74.89	1.36	9.65	3.076
Colorado	10.00	1.78	2.24	72.11	1.72	12.15	4.374
German Amber:							
Department	10.00	1.66	2.57	74.01	1.02	10.74	2.938
Colorado	10.00	1.77	2.39	71.84	1.73	12.27	4.027
Rice:							
Department	10.00	2.11	2.28	69.73	1.60	14.28	3.586
Colorado	10.00	2.06	2.35	69.70	1.94	13.95	4.103
Washington Glass:							
Department	10.00	2.02	2.19	72.20	1.81	11.88	3.741
Colorado	10.00	1.92	2.37	73.16	1.16	11.39	4.450
Swamp:							
Department	10.00	2.04	2.01	68.05	1.79	16.11	3.660
Colorado	10.00	2.05	2.30	68.89	1.85	14.91	4.423
Wysor:							
Department	10.00	1.54	2.14	72.11	1.72	12.49	3.796
Colorado	10.00	2.22	2.16	71.13	2.09	12.40	4.609
Average Seed:							
Department	10.00	1.80	2.30	71.72	1.47	12.75	3.402
Colorado	10.00	1.97	2.30	71.07	1.74	12.92	4.299
Gain for crop		9	7	9	11	6	12
Loss		3	5	3	1	6	0

The average composition of the seed is, to begin with, remarkably good, showing, that they were of fine quality, or at least a majority of them. The average for the crop shows a slight gain over the seed in ash, no change in oil, a slight loss in starch, and slight gain in fiber and albuminoids. The first question that arises is: Why have the albuminoids failed to improve more? This is explained by a study of the analyses separately. It has been shown that the average amount of albuminoids found in Professor Blount's wheats of 1881 from domestic sources was 13.04, and in the analyses of the 1882 crops it will be seen that those which were from seed containing high amounts of albuminoids fell toward the average figure, while those low in albuminoids had a tendency to rise toward it; that is to say, six increased and six decreased

their albuminoids, the average agreeing with that of 1881, which seems to point to the fact the Colorado soil has a capacity for supporting a percentage of albuminoids in a wheat of about thirteen, and that if a variety in the seed has more than this it will tend to decrease to that figure, and *vice versa*. For example: A wheat having 16.11 per cent. in the grain sown, contained only 14.91 per cent. in the grain harvested, and one having 9.65 in the seed increased to 12.15 per cent., but of course a fall happens much more readily than the reverse. The Washington Glass having only 11.88 per cent. of albuminoids in the seed failed to improve, but this is owing to an inherent dislike of this wheat wherever it grows to assimilate nitrogen, a peculiarity which Colorado could not overcome.

In the other constituents the ash increased in nine cases out of twelve, the new soil furnishing a large supply of mineral food, the oil in seven, and the fiber in eleven cases. The increase of the latter seems to be a common accompaniment of flourishing growth. In every case the size and general appearance was much improved, and, as a consequence, the weight of one hundred grains of the crop was much heavier than of the seed—in fact, averaged over twenty-six per cent. heavier.

Of the forty-four wheats from Colorado grown during two years, only one fell below 11½ per cent. of albuminoids, and only six below 12 per cent. Only two of this number weighed less than 4 grams per hundred grains. In North Carolina, on the contrary, twenty-two of whose wheats were analyzed, only two exceeded 12 per cent. of albuminoids, while the weight of one hundred grains averaged as high as 3.776. In Oregon another phase is presented, as has been before mentioned. Out of eight wheats which were analyzed by us, none contained more than 9.47 per cent. of albuminoids, or weighed less than 4.253 grams per hundred grains. In Virginia a stinted wheat was found, weighing only 1.830 per hundred grains, and yet having 14 per cent. of albuminoids. The effect of locality is well represented by these few facts, and the necessity for a determination of the weight of one hundred grains is apparent when a few of these exceptional analyses are printed side by side. From the chemical analyses alone we should be misled as to the value of the wheats which follow:

Analyses of wheats from different States.

	Oregon.	Colorado.	North Carolina.	Virginia.
Weight of 100 grains	5.745	5.193	4.628	1.830
Water	10.68	9.38	9.30	9.45
Ash	2.20	2.53	1.80	2.45
Oil	2.16	2.97	2.25	2.18
Carbhydrates	74.91	68.38	75.42	70.02
Fiber	1.65	1.59	1.95	1.90
Albuminoids	8.40	15.15	9.28	14.00
	100.00	100.00	100.00	100.00
Nitrogen	1.34	2.43	1.43	2.24

Too much confidence, it is seen, cannot be placed on the size and appearance of a wheat, or, conversely, on the chemical analysis alone. When both these elements in its constitution are favorable, then alone can it be pronounced a good wheat.

The effects upon the composition of the grain which we have studied seem to be largely dependent on the soil, seed and cultivation being the same. A good illustration of this is furnished by some analyses which were lately made of seed which was sown in 1882 on both corn ground and fallow land on a farm in Maryland belonging to Judge John M. Robinson, and of the crops from the two fields.

Fultz wheat, Queen Anne County, Maryland.

	Seed wheat, 1882.	Corn ground, 1883.	Fallow, 1883.
Weight of 100 grains	3.198	3.685	3.602
Water	11.06	11.34	11.38
Ash	1.85	1.66	1.64
Oil	1.98	2.30	1.55
Carbhydrates	73.43	73.18	72.99
Fiber	1.70	1.72	1.59
Albuminoids	9.98	9.80	10.85
	100.00	100.00	100.00
Nitrogen	1.60	1.57	1.74

The better wheat season of 1883 produced a heavier grain than 1882, but as the soil was unchanged in itself or by unusual applications of fertilizers, the albuminoids increased only slightly on the fallow field. The latter, as one would expect, produces a grain richer in nitrogen than the corn ground, from its accumulated store of nitrogen. The fallow crop, too, was larger in amount than that from the corn ground.

Further information as to the effect of soils upon wheat has been sought by analyzing the seed distributed by the Department in the last two or three years, and as many samples of the crops raised therefrom as could be obtained. The results have already been given for Colorado and proved of great interest. In no other State has there been such an extended interest taken in the subject, and the specimens are therefore more scattered. The results which have been worked out appear in the table.

No.	Name.	Locality.	Date.	Spring or winter.	Color.	Consistency.	Weight of 100 grains.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.
							Grams.	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*
784	Red Mediterranean	Department seed, first lot	1882	Winter	Red	Hard	3.601	9.83	1.70	2.21	73.73	1.68	10.85	1.74
1817	Red Mediterranean	Lee County, Alabama	1883	Winter	Red	Hard	4.077	9.68	2.01	2.22	72.29	1.55	12.25	1 96
1818	do	Fayette County, Alabama	1883	do	do	do	3.535	10.98	2.18	1.89	69.52	1.95	13.48	2.16
1820	do	Lawrence County, Alabama	1883	do	do	do	4.473	10.54	1.95	2.04	71.95	1.62	11.90	1.90
1819	do	Rusk County, Texas	1883	do	do	do	3.525	8.88	2.02	2.34	69.44	2.09	15.23	2.44
1826	do	Parker County, Texas	1883	do	do	do	3.320	11.61	1.69	2.08	70.62	1.92	12.08	1.93
1839	do	Bibb County, Georgia	1883	do	do	do	2.894	9.19	2.04	2.13	72.18	2.03	12.43	1.99
1823	do	Baker County, Georgia	1883	do	do	do	2.834	12.20	1.66	2.09	69.57	1.88	12.60	2.02
	Average						3.522	10.44	1.94	2.11	70.79	1.86	12.85	2.05
779	White Mediterranean	Imported	1882	Winter	White	Soft	4.710	10.55	1.60	2.11	72.41	2.00	10.33	1.65
1824	White Mediterranean	Bedford County, Tennessee	1883	Winter	Yellow	Soft	2.469	10.92	2.38	1.90	66.71	2.86	15.23	2.44
1825	do	Clay County, Texas	1883	do	White	do	3.700	12.05	2.02	1.59	68.95	1.91	13.48	2.16
1829	do	Colbert County, Alabama	1883	do	do	do	3.612	10.15	1.96	1.62	73.76	1.83	10.68	1.71
1834	do	Worcester County, Maryland	1883	do	do	do	3.472	11.92	1.63	1.77	70.30	2.30	12.08	1.93
1843	do	Tipton County, Tennessee	1883	do	Yellow	do	2.138	10.64	2.10	2.04	72.87	2.20	10.15	1.62
	Average						3.074	11.13	2.02	1.78	72.52	2.22	12.33	1.97
801	Rice, 1881	Department seed, Maryland	1881	Winter	Red	Hard	3.586	8.40	2.15	2.32	70.97	1.63	14.53	2.39
1836	Rice	Cape Girardeau County, Missouri	1883	Winter	Dark red	Hard		9.36	1.88	2.37	70.62	1.77	14.00	2.24
1837	do	Clinton County, Kentucky	1882	do	Red	do	3.465	10.53	1.79	1.99	69.55	1.61	14.53	2.32
1838	do	do	1883	do	do	do	3.645	10.96	1.52	1.94	69.89	1.69	14.00	2.24
	Average						3.555	10.28	1.73	2.10	70.02	1.69	14.18	2.27
809	Rice, 1882	Department seed, Maryland	1882	Winter	Red	Hard	3.095	10.00	1.80	2.18	71.89	1.88	12.25	1.96
1807	Rice	Lee County, Alabama	1883	Winter	Dark red	Hard	3.731	10.78	2.02	2.42	71.67	1.56	11.55	1.85
1840	do	Loudon County, Tennessee	1883	do	Red	do	3.734	9.19	2.04	2.15	74.40	2.24	9.98	1.60
	Average						3.733	9.99	2.03	2.29	73.03	1.90	10.76	1.73

ANALYSES OF WHEATS, 1882–'83, FROM DEPARTMENT SEED—Continued.

No.	Name.	Locality.	Date.	Spring or winter.	Color.	Consistency.	Weight of 100 grains.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.
							Grams.	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*
775	Tennessee amber	Department seed, Tennessee	1882	Winter	Amber	Hard	3.204	9.90	1.85	2.09	72.78	1.48	11.90	1.90
1809	Tennessee amber	Lee County, Alabama	1883	Winter	Amber	Lt	3,486	10.84	1.96	2.07	72.57	1.53	11.03	1.76
1835	do	Cape Girardeau County, Missouri	1883	do	do	Med		9.41	1.88	2.35	74.01	1.85	10.50	1.68
	Average						3,486	10.13	1.92	2.21	73.29	1.69	10.76	1.72
776	Osterey	Department seed, Missouri	1882	Winter	Yellow	Hard	3,340	10.24	1.80	2.31	72.37	1.73	11.55	1.85
1830	Osterey	Hancock County, Indiana	1883	Winter	Yellow	Hard	2,768	10.16	2.05	1.51	73.41	2.02	10.85	1.74

Two seed wheats from foreign sources, the Red and White Mediterranean, have been widely distributed, and several of the resulting crops returned for analysis. Of the other foreign varieties sent out by the Department, no samples have been returned. The analyses of all the imported seed which have been distributed are nine in number, and are here given.

ANALYSES OF FOREIGN WHEATS INTRODUCED INTO AMERICA AS SEED.

No.	Name.	Locality.	Year.	Spring or winter.	Color.	Consistency.	Weight of 100 grains.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.
							Grams.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
.....	Molds White	England	1878	Winter	White	Soft	.....	8.64	1.64	2.32	76.14	1.63	9.63	1.54
.....	Molds Red	do	1878	do	Red	Hard	.....	8.75	1.72	2.05	75.71	1.27	10.50	1.68
752	Russian Spring	Russia	1882	Spring	do	Soft	3.458	11.01	1.98	2.53	70.34	1.70	12.44	1.99
753	French Imperial	France	1882	do	do	do	.....	10.39	2.53	3.05	70.13	2.02	11.88	1.90
784	Red Mediterranean	Europe, first lot	1882	Winter	do	Hard	3.601	9.83	1.70	2.21	73.73	1.68	10.85	1.74
1828	Red Mediterranean	Europe, second lot	1882	do	do	do	3.500	9.88	1.62	2.05	73.80	1.79	10.85	1.74
779	White Mediterranean	Europe	1882	do	White	Soft	4.710	10.55	1.60	2.11	72.41	2.00	10.33	1.65
776	Osterey	Imported	1882	do	Red	Hard	3.340	10.24	1.80	2.31	72.37	1.73	11.55	1.85
1841	Black Sea	do	1883	do	do	do	2.532	9.78	1.74	2.06	68.48	1.87	16.10	2.58
	Average						3.523	9.90	1.93	2.30	72.56	1.74	11.57	1.85

With the exception of the small sized Black Sea wheat sent out in the autumn of 1883, they do not sustain the reputation of foreign wheats derived from the analyses which have been quoted. The results of the analyses of the crops of the Red and White Mediterranean show that although poor in themselves, the foreign wheats had a tendency to, and in almost every case did, increase their percentage of albumen wherever they were grown. They often diminished in size, however. The crops from domestic seed, on the contrary, never improved even under circumstances where the foreign seed did so.

The irregularity of the way in which the specimens were grown makes any conclusions based upon their analyses unsafe, and the results are merely recorded until they can be added to and completed. It may be said, however, that the two lots of rice wheat, distributed in 1881 and in 1882, differed in a marked degree in the amount of albuminoids they contained, and the crops from them differed in quite as marked a manner, being easily identified as from one source or the other by the albuminoids which they contained. Such a permanent difference would scarcely last any length of time if the soil were unable in any case to sustain the higher albuminoids of the 1881 seed. In Kentucky, in two cases, the high percentage was found in two successive crops, but fell off a per cent. in the second year more, and there seems to be no reason from the analyses which we have made to characterize a variety of any one name as containing under all circumstances a higher percentage of nitrogen than another.

ANALYSES IN GREATER DETAIL.

In the description of the methods of analyses an account was given of a more elaborate proximate examination than we have usually employed, and which was followed in the analyses of the Colorado wheats of 1881. Those analyses have been already printed in this form, and it merely remains to refer to certain others in the annual report of the Department for 1878 and to record in a like manner several made lately, which in the large tables by States are only given in their abbreviated form.

Detailed analyses of wheat.

	752. Russian Spring.	753. French Imperial.	754. Shumaker.	755. Clawson.	756. Fultz.	757. Shumaker.
Color	Red.	Red.			Red.	Red.
Consistency	Soft.	Soft.	Med. h'rd	Soft.	Med. h'rd	Med. h'rd
Weight of 100 grains	3.458	.....	4.377	3.856	3.454	3.349
Specific gravity	1.327	1.303	1.363	1.313	1.353	1.384
Fresh gluten	29.12	26.12	19.76	26.57	23.45	29.83
Dry gluten	10.54	9.26	7.65	9.07	7.80	9.91
Total nitrogen	1.99	1.90	1.46	1.71	1.68	1.99
Moisture	11.01	10.39	10.05	11.22	10.28	8.64
Ash	1.98	2.53	2.08	1.97	1.80	1.99
Fat	2.53	3.05	2.45	2.18	2.28	2.33
Sugar, &c	4.04	4.24	3.70	3.12	3.46	3.60
Dextrine, &c	2.40	2.34	1.74	2.00	1.60	1.68
Starch	63.90	63.55	68.57	66.47	67.80	66.83
Alb. sol. in 80 per cent. alcohol	4.19	4.44	4.53	5.66	3.43	4.15
Alb. insol. in 80 per cent. alcohol	8.25	7.44	4.60	5.03	7.07	8.29
Crude fiber	1.70	2.02	2.28	2.35	2.28	2.49
	100.00	100.00	100.00	100.00	100.00	100.00
Total N. × 6.25	12.44	11.88	9.13	10.69	10.50	12.44

	758. Zimmerman.	759. Clawson.	760. Russian No. 2.	761. Smooth Mediterranean.	762. Silver chaff.	763. Cross D '78. C
Color	Red.	Yellow.	Yellow.	Amber.	Amber.	Glassy.
Consistency	Med. h'rd	Hard.	Hard.	Med. h'rd	Hard.	Hard.
Weight of 100 grains	3.867	3.860	3.475	3.583	3.492	4.073
Specific gravity	1.373	1.364	1.384	1.352	1.364	1.413
Fresh gluten	28.49	25.24	28.29	29.58	28.97	26.37
Dry gluten	9.79	9.16	9.79	9.97	10.03	9.27
Total nitrogen	1.82	1.79	1.76	1.88	1.79	1.71
Moisture	9.18	9.18	8.43	9.45	10.99	10.87
Ash	2.01	1.91	2.09	1.89	2.22	1.75
Fat	2.35	2.16	2.23	1.80	2.42	2.04
Sugar, &c	3.36	3.70	3.14	3.12	3.40	3.18
Dextrine, &c	1.54	1.68	1.56	1.86	1.76	2.00
Starch	67.61	67.90	68.83	67.45	65.73	66.95
Alb. sol. in 80 per cent. alcohol	3.64	5.17	4.92	5.30	4.58	3.97
Alb. insol. in 80 per cent. alcohol	7.74	6.02	6.08	6.45	6.61	6.72
Crude fiber	2.57	2.28	2.72	2.68	2.29	2.52
	100.00	100.00	100.00	100.00	100.00	100.00
Total N. × 6.25	11.38	11.19	11.00	11.75	11.19	10.69

[Locality, &c.: Nos. 752, 753, spring wheat distributed by Department. Nos. 754, 755, W. J. Beall, Lansing, Mich. Nos. 756–762, Missouri Agricultural College. No. 763, Hosford, Vt.]

At present no attempt at interpretation of these data seems desirable.

GLUTEN.

In a large number of the wheats which have been analyzed, determinations of gluten have been made mechanically. The results are here tabulated:

Serial number.	Per cent. of total nitrogen.	Per cent. of albuminoids.	Per cent. of moist gluten.	Per cent. of dry gluten.	Ratio of dry to moist gluten.	Factor for nitrogen to dry gluten.
731	1.79	11.20	25.23	8.91	35.3	4.97
744	1.88	11.73	26.91	9.99	37.1	5.31
721	1.88	11.73	32.92	11.19	34.0	6.48
728	1.88	11.73	25.06	9.49	37.8	5.05
727	1.93	12.08	23.80	9.22	38.7	4.77
720	1.96	12.25	32.24	11.38	35.3	5.81
725	1.96	12.25	35.22	11.74	33.3	6.00
730	1.96	12.25	33.59	12.10	36.0	6.17
738	1.96	12.25	28.92	10.06	34.8	5.13
724	1.99	12.43	36.96	12.14	32.8	6.10
726	2.02	12.60	28.31	10.64	37.6	5.26
723	2.07	12.95	32.22	10.74	33.3	5.19
741	2.07	12.95	29.52	11.23	38.0	5.41
746	2.07	12.95	30.14	10.69	35.5	5.16
742	2.16	13.48	34.78	11.83	34.0	5.63
736	2.16	13.48	33.05	10.90	33.9	5.04
722	2.18	13.65	34.16	11.88	34.8	5.45
732	2.18	13.65	35.15	11.93	33.9	5.47
745	2.18	13.65	34.01	12.11	35.6	5.55
748	2.18	13.65	34.32	13.08	38.1	6.00
729	2.21	13.83	42.12	14.33	34.0	6.49
747	2.24	14.00	32.24	11.37	35.3	5.08
750	2.24	14.00	35.81	12.52	34.9	5.58
733	2.27	14.18	35.36	12.07	34.1	5.31
739	2.27	14.18	34.86	11.83	33.9	5.19
734	2.32	14.53	32.41	12.13	37.4	5.23
735	2.35	14.70	35.01	12.34	35.2	5.25
737	2.42	15.05	38.33	14.45	37.7	6.00
743	2.44	15.23	33.69	12.06	35.8	4.94
749	2.44	15.23	37.54	13.51	35.9	5.54
751	2.44	15.23	36.61	13.83	37.8	5.66
740	2.55	15.93	39.47	14.23	36.0	5.58
Average.	2.14	13.38	33.12	11.74	35.5	5.49

Wheats from Colorado, 1882.					Seed from Department, 1881.				
Serial number.	Per cent. of nitrogen.	Per cent. of albuminoids.	Per cent. of moist gluten.	Per cent. of dry gluten.	Serial number.	Per cent. of nitrogen.	Per cent. of albuminoids.	Per cent. of moist gluten.	Per cent. of dry gluten.
786	.....	.....	.....	....	785	2.18	13.65	37.05	14.50
788	2.02	12.60	32.74	12.37	787	1.88	11.72	24.24	10.15
790	1.90	11.90	28.62	11.57	789	1.76	11.03	24.29	9.27
792	2.32	14.53	33.61	13.16	791	2.02	12.60	23.48	9.16
794	2.18	13.65	36.42	13.19	793	2.24	14.00	34.35	13.27
796	1.99	12.43	33.58	12.35	795	2.49	15.58	46.17	17.19
798	1.96	12.25	32.55	11.86	797	1.57	9.80	9.67	3.82
800	1.99	12.43	37.79	.....	799	1.76	11.03	19.88	8.08
802	2.27	14.18	45.26	15.54	801	2.32	14.53	38.66	13.99
804	1.85	11.55	26.29	10.16	803	1.93	12.08	25.84	9.78
806	2.38	14.88	40.95	15.06	805	2.66	16.63	47.57	17.83
808	2.02	12.60	36.90	13.18	807	2.02	12.60	36.35	12.83
Average.	2.09	13.06	34.69	12.89	Average.	2.07	12.94	30.63	11.66
Highest	2.38	14.88	45.26	15.54	Highest	2.66	16.63	47.57	17.83
Lowest .	1.85	11.55	26.29	10.16	Lowest .	1.57	11.03	9.67	3.82

Wheats from North Carolina, 1882.

Serial number.	Per cent. of nitrogen.	Per cent. of albuminoids.	Per cent. of moist gluten.	Per cent. of dry gluten.	Serial number.	Per cent. of nitrogen.	Per cent. of albuminoids.	Per cent. of moist gluten.	Per cent. of dry gluten.
811	1.76	11.03	27.68	10.56	824	1.62	10.15	23.98	9.18
812	1.43	8.93	12.78	5.16	825	1.90	11.90	30.55	11.55
813	1.65	10.33	17.47	6.99	826	1.48	9.28	17.62	7.12
814	1.62	11.15	23.01	9.02	827	1.54	9.63	18.31	7.18
815	1.60	9.98	24.45	9.25	828	1.82	11.38	27.32	10.63
816	1.54	9.63	17.77	6.92	829	1.96	12.25	32.49	12.05
817	1.51	9.45	25.23	9.55	830	1.99	12.43	32.39	12.38
818	1.60	9.88	22.14	8.46	831	1.60	9.98	22.18	8.74
819	1.79	11.20	30.43	11.30					
820	1.46	9.10	18.81	7.73	Average.	1.67	10.50	23.94	9.26
822	1.71	10.68	23.00	9.54					
823	1.88	11.73	31.24	11.97	Highest.	1.99	12.43	32.49	12.38
					Lowest..	1.43	8.93	12.78	5.16

Wheat from Oregon.					Wheat from Virginia.				
Serial number.	Per cent. of nitrogen.	Per cent. of albuminoids.	Per cent. of moist gluten.	Per cent. of dry gluten.	Serial number.	Per cent. of nitrogen.	Per cent. of albuminoids.	Per cent. of moist gluten.	Per cent. of dry gluten.
772	1.37	8.58	3.11	1.24	780	2.24	14.00	37.41	14.01
773	1.29	8.05	16.89	6.34	781	1.62	10.15	11.37	4.39
774	1.34	8.40	5.04	2.04	782	1.85	11.55	26.39	11.66

Relation of gluten to nitrogen, and of dry to moist gluten.

	Dry gluten to nitrogen.	Dry to moist gluten.
In Colorado wheat, 1881.....	5.49	35.55
In Colorado wheat, 1882.....	6.12	34.56
In seed sent to Colorado, 1881.	5.63	38.07
In North Carolina wheat ...	5.54	38.68
In Oregon wheat.....	2.41	38.20
In Virginia wheat	5.22	39.98

The average gluten in the Colorado wheats of 1882 has improved over that in the seed furnished by the Department, although the average nitrogen is alike in both. This may, however, be due to the fact that many wheats after they have been preserved a year do not yield as much gluten as when they are fresh. This has been noticed in examination of the wheats grown in 1879, which we have had in hand this year, and for that reason determinations of gluten in these specimens have been omitted. As an example of the effect of time upon the gluten I have recently had some duplicate determinations made with wheats which had already been examined a year ago.

Duplicate determinations of gluten in wheat grown in 1882.

No.	Determinations made in 1882.		Determinations made in 1883.	
	Per cent of moist gluten.	Per cent. of dry gluten.	Per cent. of moist gluten.	Per cent. of dry gluten.
752	29.12	10.54	23.39	9.51
753	26.12	9.26	22.61	9.19
754	19.76	7.05	.00	.00
756	23.45	7.80	10.70	4.17

The later determinations are seen to be the lowest, but there is much difference in the way varieties act. No. 753, for instance, loses but slightly, while it was found to be impossible by the most careful manipulation to extract any gluten from No. 754 after it had stood a year.

An explanation is thus furnished of the fact that No. 797 of the seed wheats sent to Colorado has such an extremely low percentage of gluten. It had been preserved more than a year before the gluten was determined, and was a wheat which could not resist the action of time. Examinations of wheats at intervals in this way will distinguish their keeping qualities, a matter of great importance. Among the flours analyzed and described elsewhere is one which, from its low percentage of gluten and abnormal relation to its nitrogen content, is shown to be without any ability to withstand the effects of storage for a long time. It may safely be said that if a wheat or flour is found whose gluten falls below four times its nitrogen it has been injured by storage or some other injurious action; and from our averages it is apparent that a good wheat should contain as much as five and a half times as much gluten as nitrogen.

The North Carolina wheats contain the same relative amounts of nitrogen, and of moist and dry gluten as those from Colorado, and are in no way abnormal, but they show how low the gluten descends in our poorer Eastern wheats.

In the samples from Oregon and Virginia, on the contrary, the relations are very irregular. Those from Oregon are all extremely low, and only one within the limit of the necessary relation to the nitrogen. These wheats may have become injured, but it is more probable that it is an inherent peculiarity of the Oregon grain, for, as has been previously shown, the wheat from that State, at least as far as it has been examined, is quite different from any other wheat with which we are acquainted.

The specimens from Virginia are peculiar in that No. 780, the smallest wheat yet examined, weighing only 1.803 per 100 grains, is quite normal in its gluten content, while No. 781, grown under slightly more advantageous conditions directly beside it, is quite as abnormal.

Something in the method of harvesting or preservation of the sample must be the cause of this, but the determinations would be sufficient to show that No. 780, small as it is, would be preferable for bread-making to No. 781.

The crude gluten, after it has been extracted from the wheat, consists, as is well known, of the four principal nitrogenous constituents of the wheat, the fifth, albumen or cerealin, being washed away, and in addition there are present numerous impurities, including in the dry substance a small portion of water, which can only be removed at a high temperature, some fat, starch, and fiber. To determine the relative amount of these substances the following analysis of an average sample of crude gluten has been made.

Composition of crude gluten dried at 100° *C.*

Water	3.97
Ash	2.90
Fat	4.97
Fiber	3.24
N. × 6.25	74.19
Undetermined non-nitrogenous	10.73
	100.00

Only about 74 per cent. of the crude gluten is pure, and the remainder impurities; that is to say, if the pure gluten is supposed to contain 16 per cent. of nitrogen. As there were 10.73 per cent. of the crude substance which was neither water, ash, fat, nor fiber, and it seemed improbable that this could all be starch, the question arose as to whether the pure gluten did not contain less than 16 per cent. of nitrogen. Ritthausen had suspected from his work that variations in the amount of nitrogen in the constituents of gluten was possible, and in order to decide this point a small amount of pure substance was made from flour and analyzed with the following result: Ash-free gluten, dried at 130° C., contained 15.94 per cent. of nitrogen. 6.25 then is, without doubt, the proper factor to employ, and the undetermined 10.73 per cent. must consist of impurities. This amount is larger than that found by Ritthausen, but it seems to remain constant in all cases with the same method of manipulation, as is shown by the small variation in the relation of the crude gluten to the nitrogen, and therefore does not affect the results as a means of comparison of wheats, and judging of their milling qualities. It must merely be borne in mind that we are dealing with a crude, not a pure, gluten.

The relation between nitrogen and gluten in wheats which we have found agrees very well with Ritthausen's figures, but the amount is lower, as we might expect from the inferior amount of nitrogen in our wheats. He found that the dry gluten averaged 14.38 per cent, or 5.64 times the nitrogen, and his analyses show that the crude gluten which he obtained was rather purer than ours.

FLOUR AND BREAD.

The subject of flours and the bread produced from them has been very extensively considered on the continent of Europe and nowhere has

there been more attention given to it than in Hungary and in Vienna. In the reports of the United States Commissioners to the Vienna Exhibition of 1873, Professor E. W. Horsford has given an extensive paper upon the subject.

In considering the immediate causes of heavy and light bread, he shows that the gluten of the flour is the body whose tenacity and elasticity when in the dough enables it to hold the bubbles of gas which are formed in the process of rising, and that, consequently, a flour deficient in gluten cannot make a light bread. The gluten, however, when present in sufficient amount, must be in such a physical condition as not to be injured and discolored by the fermentation which goes on in the dough through the action of the yeast. The methods of milling are, of course, responsible for the condition in which the gluten is left in the flour originally, but the length of time and manner in which the flour is preserved have their ultimate effect upon it.

With a view to a study of the quality of some of our American flours in common use and the breads and other products made from them, the following analyses have been made:

986–992. Breads, rolls, buns, and cakes from J. Seitz bakery, Washington, D. C., purchased immediately after coming from the oven.

1135–1140. Flours used in making the previous breads, &c., and designated as follows:

1135. "Eagle Bluff." Illinois spring wheat.

1136. "Red River." Minnesota spring wheat.

1137. "Wife's Delight." Wisconsin spring wheat.

1138. "Richmond." Virginia winter wheat.

1139. "E. A. Schriver." Maryland winter wheat.

1140. "Red S." Ohio winter wheat.

1121–1122. Flour and bread made from it in the family of John Dugan. Received thirty-six hours after coming from the oven.

1177–1180. Flour and bran, and white and Graham bread made therefrom. Purchased at Kraft's bakery, Washington, D. C.

1181–2, 1194–1196. Flours, bread, and biscuits from my own kitchen

BREADS.

	986. Family loaf.	987. Graham loaf.	988. French rolls.	989. Beaten rolls.	990. Sweet buns.	991. Sugar cakes.
Dry substance.						
Ash	1.86	1.80	1.91	1.55	2.15	.78
Fat	.95	1.00	3.41	5.65	6.18	11.30
Sugars, &c	3.45	4.37	4.29	5.21	10.89	27.60
Dextrine	4.55	4.90	4.10	3.64	4.37	2.01
Starch	75.00	72.87	71.69	68.94	64.40	46.83
Soluble albuminoids	1.90	3.01	3.44	1.56	2.64	2.60
Insoluble albuminoids	10.93	10.27	9.78	10.65	8.93	5.74
Fiber	1.36	1.78	1.38	2.81	.44	3.14
	100.00	100.00	100.00	100.00	100.00	100,00
Nitrogen	2.05	2.12	2.11	1.96	1.85	1.33
Total albuminoids	12.83	13.28	13.22	12.21	11.57	8.34
Per cent. of crust	55.65	56.50	64.93	50.44	62.10	.....
Original substance.						
Water	37.30	37.88	32.24	24.21	26.99	8.79
Ash	1.17	1.12	1.29	1.17	1.57	.71
Fat	.60	.62	2.31	4.28	4.51	10.31
Sugars, &c	2.16	2.71	2.91	3.95	7.95	25.18
Dextrine	2.85	3.04	2.78	2.76	3.19	1.83
Starch	47.03	45.27	48.58	52.25	47.02	42.71
Soluble albuminoids	1.19	1.87	2.33	1.18	1.93	2.37
Insoluble albuminoids	6.85	6.38	6.63	8.07	6.52	5.24
Fiber	.85	1.11	.93	2.13	.32	2.86
	100.00	100.00	100.00	100.00	100.00	100.00
Nitrogen	1.29	1.32	1.43	1.48	1.35	1.22
Total albuminoids	8.04	8.25	8.96	9.25	8.45	7.61

FLOURS.

	992. Molasses cakes.	1121. Bread, John D.	1122. Flour, John D.	1135. Eagle Bluff Spring.	1136. Red River Spring.	1137. Wife's Delight Spring.
Dry substance.						
Ash	2.38	2.56	.68	.91	.58	.46
Fat	4.37	1.09	1.09	1.52	1.23	1.32
Sugars, &c	36.08	4.69	1.36	2.17	2.34	1.85
Dextrine	3.56	6.42	4.14	2.19	1.18	1.76
Starch	45.19	73.29	79.65	79.00	81.43	83.17
Soluble albuminoids	.90	.92	2.90	2.90	2.61	3.39
Insoluble albuminoids	7.97	10.15	9.23	10.88	9.74	7.60
Fiber	.45	.88	.45	.43	.89	.45
	100.00	100.00	100.00	100.00	100.00	100.00
Nitrogen	1.27	1.76	1.95	2.20	1.98	1.75
Total albuminoids	7.97	11.07	12.13	13.78	12.35	10.99
Original substance.						
Water	10.22	30.32	12.00	12.30	13.55	12.40
Ash	2.14	1.79	.60	.80	.50	.40
Fat	3.93	.76	.96	1.33	1.06	1.16
Sugars, &c	32.39	3.27	1.64	1.90	2.02	1.62
Dextrine	3.20	4.47	3.64	1.92	1.02	1.54
Starch	40.57	51.07	70.08	69.29	70.40	72.86
Soluble albuminoids	.00	.64	2.56	2.54	2.26	2.97
Insoluble albuminoids	7.15	7.07	8.12	9.54	8.42	6.66
Fiber	.40	.61	.40	.38	.77	.39
	100.00	100.00	100.00	100.00	100.00	100.00
Nitrogen	1.14	1.23	1.71	1.93	1.71	1.54
Total albuminoids	7.15	7.71	10.68	12.08	10.68	9.63

FLOURS.

	1138. Richmond Winter.	1139. E. A. S. Ind. Winter.	1140. Red S. Ohio Winter.	1177. White Loaf.	1178. Graham bread.	1179. Flour 1177.
Dry subseance.						
Ash	.62	.73	.73	1.75	2.81	.51
Fat	1.48	1.61	1.52	.52	1.22	1.37
Sugars, &c	1.86	1.74	1.80	2.44	5.73	1.97
Dextrine	1.84	2.30	2.34	5.20	4.80	2.36
Starch	82.22	82.89	80.62	75.82	69.53	78.93
Soluble albuminoids	4.79	2.33	3.83	2.02	1.88	2.24
Insoluble albuminoids	6.74	7.95	8.57	11.19	12.17	10.59
Fiber	.45	.45	.59	1.06	1.86	2.03
	100.00	100.00	100.00	100.00	100.00	100.00
Nitrogen	1.84	1.64	1.99	2.11	2.25	2.05
Total albuminoids	11.53	10.28	12.40	13.21	14.05	12.83
Original substance.						
Water	11.95	11.40	11.05	36.07	33.22	11.70
Ash	.55	.65	.65	1.12	1.88	.45
Fat	1.30	1.43	1.35	.33	.81	1.21
Sugars, &c	1.64	1.54	1.60	1.56	3.83	1.74
Dextrine	1.62	2.04	2.08	3.33	3.20	2.08
Starch	72.39	73.44	71.71	48.47	46.43	69.70
Soluble albuminoids	4.22	2.06	3.41	1.29	1.26	1.98
Insoluble albuminoids	5.93	7.04	7.62	7.15	8.13	9.35
Fiber	.40	.40	.53	.68	1.24	1.79
	100.00	100.00	100.00	100.00	100.00	100.00
Nitrogen	1.62	1.46	1.76	1.35	1.50	1.82
Total albuminoids	10.15	9.10	11.03	8.44	9.39	11.38

FLOURS.

	1180. Bran 1178.	1181. Biscuit, Wisery.	1182. Flour, Wisery.	1194. Biscuit, Wisery.	1195. Loaf, Wisery.	1196. Flour, Wisery.
Dry substance.						
Ash	.77	1.37	.45	.11	1.20	.55
Fat	5.58	3.61	1.49	5.08	4.74	1.21
Sugars, &c	7.21	4.27	1.55	3.88	3.42	2.17
Dextrine	3.69	6.80	2.02	8.55	8.89	2.30
Starch	59.27	71.73	81.55	68.47	68.88	80.89
Soluble albuminoids	1.86	1.47	3.58	1,35	1.75	2.74
Insoluble albuminoids	13.06	10.18	8.63	11.22	10.13	9.83
Fiber	8.56	.57	.73	1.34	.99	.31
	100.00	160.00	100.00	100.00	100.00	100.00
Nitrogen	2.39	1.86	1.96	2.01	1 90	2.01
Total albuminoids	14.92	11.65	12.21	12.57	11.88	12.57
Original substance.						
Water	8.50	33.40	11.10	34.69	32.94	9.55
Ash	.70	.91	.40	.07	.81	.50
Fat	5.11	2.41	1.32	3.32	3.18	1.09
Sugars, &c	6.60	2.84	1.38	2.53	2.29	1.96
Dextrine	3.38	4.53	1.80	5.58	5.96	2.08
Starch	54.23	47.77	72.50	44.72	46.19	73.16
Soluble albuminoids	1.70	.98	3.18	,88	1.18	2.48
Insoluble albuminoids	11.95	6.78	7.67	7.33	6.79	8.90
Fiber	7.83	.38	.65	.88	.66	.28
	100.00	100.00	100.00	100.00	100.00	100.00
Nitrogen	2.18	1.24	1.74	1.32	1.27	1.82
Total albuminoids	13.65	7.76	10,85	8.21	7.97	11.38

The flours, as a whole, contain, average albuminoids, 10.69 per cent., and the difference between those from spring and winter wheats is small—10.65 winter, and 10.79 spring. They may be said, as far as the analyses go, to be equally good.

Considered in comparison with Hungarian flours, they are low in albuminoids, but this might be expected from our previous experience with wheats. Taken by themselves, they show a rather wide variation the highest having 12.08 per cent., and the lowest 9.10 per cent., the greatest variation being among the spring wheats. The average seems to be as high as could be expected from the wheats which we have analyzed from the sections from which these flours came, there being always a slight falling off in the amount of nitrogen in the best flour from that in the grain.

In their other constituents the flours show a plain and marked decrease, as compared to the grain, in ash and fat, these two substances being contained in much larger amount in the outer coats of the grain which are removed than in the portion which forms the flour. The fiber, for the same reason, is, as we should expect, much smaller.

The amount of starch necessarily increases proportionately as the other constituents diminish.

The average of all these flours is compared below, with analyses of Hungarian flours given by Horsford.

	American.	1. Imp. Extra.	4. Roll flour.	6. Bread flour.
Water	11.67	10.62	10.42	10.75
Ash	.54	.42	.59	.76
Oil	1.25			
Sugars	1.71			
Dextrine	1.79			
Starch	71.72	71.02	67.30	65.63
Soluble albuminoids	2.80			
Insoluble albuminoids	7.90			
Fiber	.62			
Total albuminoids	10.70	11.56	12.37	14.56

The original Hungarian wheat containing 14 per cent. of albuminoids and the average American certainly not more than 12 per cent., it appears that our flours are related to our wheat in fully as advantageous manner as the Hungarian, if they can be considered as corresponding either to the Imperial Extra or Roll flours, which seems allowable.

Kedzie and Atwater have analyzed twenty-eight flours from Michigan, Kansas, Minnesota, and Connecticut, and the results have been collected by Dr. Jenkins in the Report of the Connecticut Agricultural Station for 1879.

Kedzie found that the flours from spring wheats contained more albuminoids than those from winter wheats, but the average for all varieties is very nearly the same as for the flours which we have analyzed.

	Per cent
Kedzie's spring wheat flour	12.58
Kedzie's winter wheat flour	10.54
Average of twenty-eight flours	10.89
Average of Department of Agriculture flours	10.70

The flours are shown by Kedzie's analyses to be somewhat independent of the composition of the grain, but, as a rule, there is a greater or less loss of ash and albuminoids in the making of flour. His paper will be found in the Michigan Agricultural Report, 1877.

As has been said before, the condition of the nitrogen, or, rather, the amount present as gluten, has much to do with the quality of the flour for baking purposes.

In the six flours from Mr. Seitz's the gluten has been determined mechanically.

Gluten in flours.

No.	Name.	Nitrogen.	Albuminoids.	Moist gluten.	Dry gluten.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
1135	Eagle Bluff, Illinois Spring	1.93	12.08	39.46	12.98
1136	Red River, Minnesota Spring	1.71	10.68	7.32	2.80
1137	Wife's Delight, Wisconsin Spring	1.54	9.63	24.89	10 30
1138	Richmond, Virginia Winter	1.62	10.15	28.13	10.37
1139	E. A. Schriver, Maryland Winter	1.46	9.10	25.14	9.92
1140	Red "S," Ohio Winter	1.76	11.03	31.20	11.67
	Average	1.67	10.45	26.02	9.67

The Hungarian flours, according to Horsford, average 37 per cent. of moist gluten, so that ours, with the exception of that from Illinois spring wheat, are below the average.

That from Minnesota wheat would certainly make a poor bread and must have deteriorated by keeping.

Kedzie's determinations of gluten in sixteen flours, having an average of 10.69 per cent. albuminoids, showed an average of only 10.72 per cent. of gluten, slightly better than in the Washington flours, but still low. Under these circumstances, the question arises, can we have as good bread, that is to say, as light flours and palatable as the Vienna? Although Horsford sees no reason why we cannot, it seems to me that while our wheats and consequently our flours remain so poor in gluten we cannot, without particular care to find such a brand as the "Eagle Bluff," and even that would probably vary on every grinding.

In the analyses of different grades of Hungarian flour which were mentioned above, the decrease in amount of the albuminoids in the higher grades is apparent.

The difference between the flour and the bran which is mixed with it at the Kraft bakery shows that the same is true in our mill products and that the Graham bread contains the greater percentage of albuminoids, and the same would be found to be true in regard to the valuable ash constituents. It has been a moving question for a long time

whether this ought not to be avoided and whole flour preferred to that which has been so highly elaborated.

Recent experiments by Dr. Max Rubner, published in the Zeitschrift für Physiologische Chemie, 1883, p. 45, seem to prove that, in addition to the argument in favor of white bread on account of its palatability and many other advantages, it is, in fact, much more thoroughly digested, and consequently is really cheaper, weight for weight, to the poor man than the bread made with unbolted flour. We can only hope, then, for an improvement in the character of our wheats to add to their nitrogen content, and to improved methods of milling which we are fast becoming possessed of, to make it possible to produce a flour with the highest amount of nitrogen in the higher grades, and at the same time with it in the best physical condition. Then we may expect to improve our breads.

CHEMICAL COMPOSITION OF BREADS, ETC.

The changes which take place in flour during its conversion into various forms of bread and cake is well illustrated in the analyses given in the table.

The amount of water in the numerous kinds analyzed extends from nearly 38 in the breads to 9 per cent. in the sugar cakes, the beaten rolls and buns occupying a medium position. The amount of water, however, decreases very rapidly on exposure to the air, as the following determinations in a white and Graham loaf show, and in some rolls of domestic make:

WHITE LOAF FROM KRAFT'S BAKERY.

(Serial No. 1177.)

	Weight.	Per cent. lost of the total water present.	Per cent of water in the bread on the day named.
	Grams.		
On leaving bakery:			
August 22	452	.....	36.07
On exposure:			
August 23	422	18.39	31.51
August 24	390	38.04	25.90
August 25	379	44.77	23.75
August 26	364	53.98	20.60
August 27	.....	.....	.....
August 28	346	65.01	16.47
August 29	333	73.00	12.91
August 30	326	77.27	11.35
August 31	323	79.12	10.52
September 1	318	82.17	9.12
September 6	307	88.97	5.86

After drying two weeks there had disappeared all but 11.03 per cent. of the original water, and the air dry material only contained 5.86 per cent. of water.

GRAHAM LOAF FROM KRAFT'S BAKERY.

(Serial No. 1178.)

	Weight.	Per cent. lost of total water present.	Per cent. water in bread.
On leaving bakery:	*Grams.*		
August 22	464	.....	33.22
On exposure to air:			
August 23	440	15.58	29.55
August 24	412	33.77	24.75
August 25	403	39.61	23.07
August 26	384	51.95	19.27
August 27	.....	.....	.....
August 28	369	61.69	15.99
August 29	355	70.78	12.68
August 30	350	74.02	11.43
August 31	346	76.62	10.40
September 1	338	81.82	8.28
September 6	323	85.06	4.02

BREAKFAST ROLLS.

(Serial No. 1194.)

	Weight.	Per cent. lost of total water present.	Per cent. water in bread.
On leaving oven:	*Grams.*		
August 23	364	.....	34.69
On exposure:			
August 24	328	28.50	27.44
August 25	314	39.59	23.17
August 26	293	57.00	18.77
August 27	.....	.....	.....
August 28	277	68.88	14.08
August 29	266	77.59	10.53
August 30	261	81.55	8.81
August 31	259	83.14	8.11
September 1	259	83.14	8.11
September 6	256	85.51	7.03

The loaf breads dry more thoroughly, but do not lose their water as rapidly at first as the rolls. The rolls, it may be said, which were used in this experiment, were eight in number from a pan of twenty, and were not broken apart during the course of exposure.

The changes of a chemical nature displayed are those which are already tolerably well known, namely, the conversion of some of the starch by fermentation into sugar, and by baking into dextrine.

The albuminoids which in the flour are soluble in alcohol become insoluble, showing that change has taken place in the gluten.

The apparent increase in ash and fat is, of course, due to salt and butter or lard added in making the dough.

CORN (MAIZE).

The varieties of maize or corn which have been analyzed by us and by other investigators whose analyses have been collected include—

Dent: Red, Yellow, White, and Miscegenation;

Flint: Yellow, White, Blue Mexican, and Miscegenation; and

Sugar or sweet corn.

They amount to one hundred and thirty-three in number, of which thirty-two field and three sugar corns are by Johnson, Atwater, and Kedzie.

The latter have been included, with proper acknowledgment, among our analyses, as a valuable addition to our data for the calculation of local averages.

The specimens which we have had in hand are for the most part sufficiently accurately identified in the tables of analyses. It is only necessary to add that Nos. 18–24 Sugar corns were of the Department distribution of seed in 1878. Nos. 31, 33, 34, 36, 37, 38, 39, 40, 42, 43, 44, 45 were collected by the New Hampshire Board of Agriculture in 1878.

Nos. 1244–1254, 1256–1271 were from the Missouri Agricultural College in 1879.

No. 1255 was from V. W. Metcalf, Hopkinsville, Ky., in 1879.

Nos. 1272, 1273, 1275, 1277 were from the Eastern Experimental Farm, Chester County, Pennsylvania, in 1879.

Nos. 1945–1967 were from the exhibit of the Texas and Pacific Railroad in the Department museum.

Nos. 1961–1967 were from the exhibit of the Atchison, Topeka and Santa Fé Railroad.

Nos. 1968–1970 were from the exhibit of the Texas and Arkansas Railroad.

Most of these samples had been preserved some time before they came into our hands, and had, consequently, dried out, making the determinations of moisture rather lower than would be found in fresh corn.

The specimens, it will be seen, are not from so many localities as the wheats, but they are widely scattered and furnish data which are entirely suited for a study of the variations in composition and for a comparison with wheat.

The methods of analysis have been exactly the same as were used with wheat, and the more detailed analyses of corn correspond in every particular with those, made in the same way, of wheat.

RESULTS.

The results upon which the conclusions in regard to corn are based are arranged in the following tables by States, in the same way as was done with the analyses of wheats. They explain themselves.

Number.	Name.	Variety.	Date.	Weight of 100 kernels.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Analyst.
	NEW HAMPSHIRE:			*Grams.*	*Pr.cent.*	*Pr.cent.*	*Pr.cent.*	*Pr.cent.*	*Pr.cent.*	*Pr.cent.*	*Pr.cent.*	
31	Small Eight-rowed	White Corn	1878		11.05	1.57	4.80	67.63	1.30	13.65	2.18	Dep't of Agric.
33	Adam's	Yellow Corn	1878	.....	8.61	1.57	4.83	73.30	1.19	10.50	1.68	Do.
34	Canada	do	1878	.....	8.27	1.72	5.60	71.79	1.26	11.36	1.82	Do.
36	Small Twelve-rowed	do	1878	.....	11.48	1.34	6.03	69.56	1.09	10.50	1.68	Do.
37	State Fair Premium	do	1878	.....	10.19	1.78	5.29	70.86	1.06	10.82	1.74	Do.
38	Large Premium	do	1878	.....	10.00	1.46	5.52	70.57	1.09	11.36	1.82	Do.
39	Board of Agriculture	do	1878	.....	11.09	1.31	4.68	70.55	.82	11.55	1.85	Do.
40	King Philip	Red Corn	1878	.....	10.23	1.84	7.05	67.79	1.01	12.08	1.93	Do.
42	Miscegenation	White and Blue	1878	.....	9.92	1.63	5.33	70.35	1.05	11.72	1.88	Do.
43	Pitch Knot		1878	.....	11.24	1.52	5.26	69.74	1.04	11.20	1.79	Do.
44	Tom Thumb Pop	Yellow Corn	1878	.....	9.05	1.60	5.89	69.53	1.33	12.60	2.02	Do.
	VERMONT:											
35	Vermont	Yellow Corn	1878	.....	8.64	1.45	5.63	72.76	1.38	10.14	1.62	Dep't of Agric.
	PENNSYLVANIA:											
28	White Prolific	White Corn	1878	.....	8.96	1.43	5.82	74.49	1.25	8.05	1.29	Dep't of Agric.
32	Compton's Early	Yellow Corn	1878	.....	6.59	1.64	5.30	74.48	2.09	9.90	1.59	Do.
1235	Pride of North	do	1882	30.610	8.60	1.25	4.65	73.10	2.25	10.15	1.62	Do.
1259	Chester County Mammoth	Yellow Dent	.....	44.147	7.80	1.40	4.82	74.90	2.33	8.75	1.40	Do.
1272	Field Corn	Red Dent	.....	37.202	7.85	1.45	5.49	75.73	1.95	7.53	1.20	Do.
	NORTH CAROLINA:											
26	White Dent	White Dent	1878	.....	6.74	1.43	5.18	74.09	1.53	11.03	1.76	Dep't of Agric.
	KENTUCKY:											
1255	Willis	White Dent	.....	32.457	7.70	1.50	5.33	73.47	2.20	9.80	1.57	Dep't of Agric.
	TENNESSEE:											
25	Improved Prolific	White Corn	1878	.....	7.58	1.23	5.09	74.16	2.65	9.29	1.48	Dep't of Agric.
	MISSOURI:											
1244	Tuscarora	White Flint	.....	35.582	7.70	1.85	5.34	71.65	2.08	11.38	1.82	Dep't of Agric.
1245	Proctor's Bread	White Dent	.....	30.837	7.90	1.65	4.65	74.12	2.05	9.63	1.54	Do.
1246	Long John	do	.....	41.689	8.05	1.75	4.87	72.22	2.08	11.03	1.76	Do.
1247	Saint Charles	do	.....	34.183	8.20	1.75	6.29	72.43	3.10	8.23	1.32	Do.
1248	Snow Flake	do	.....	52.679	7.80	1.65	4.34	74.83	1.75	9.63	1.54	Do.
1249	Ragan's White	do	.....	39.672	8.25	1.80	6.14	70.18	2.60	11.03	1.76	Do.
1250	Peabody	do	.....	32.323	7.95	2.05	7.49	69.93	2.60	9.98	1.60	Do.
1251	Badean	do	.....	37.011	8.45	2.10	5.82	69.85	2.93	10.85	1.74	Do.
1252	Blount's Prolific	do	.....	38.753	8.05	2.05	5.33	70.34	1.98	12.25	1.96	Do.
1253	White Flint	White Flint	.....	34.958	7.60	1.55	4.93	71.52	2.50	11.90	1.90	Do.
1254	Thompson's	White Dent	.....	43.662	8.30	1.80	4.94	69.78	2.58	12.60	2.02	Do.
1256	Ragan's Yellow	Yellow Dent	.....	42.651	8.50	1.45	4.85	73.44	2.13	9.63	1.54	Do.

Number.	Name.	Variety.	Date.	Weight of 100 kernels.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Analyst.
	MISSOURI—Continued.			*Grams.*	*Pr.cent.*	*Pr.cent.*	*Pr.cent.*	*Pr.cent.*	*Pr.cent.*	*Pr.cent.*	*Pr.cent.*	
1257	Chester County	Yellow Dent	------	33.595	8.05	1.45	6.31	70.69	2.65	10.85	1.74	Dep't of Agric.
1258	Golden Yellow	do	------	35.343	8.30	1.60	5.38	72.79	1.43	10.50	1.68	Do.
	CONNECTICUT:											
	Vermont White Cap	Flint Corn	1877	------	10.86	1.53	4.29	71.22	1.04	11.06	1.76	S. W. Johnson.
	Rowley	do	1877	------	11.00	1.61	4.83	70.15	.78	11.63	1.86	Do.
	Yellow Rowed or Canada	do	------	------	15.10	1.36	5.31	66.98	1.24	10.01	1.60	W. O. Atwater.
	Old Fashioned Yellow	do	1878	------	10.58	1.43	4.68	72.11	1.39	9.81	1.57	S. W. Johnson.
	Ohio Dent	Dent Corn	1877	------	10.78	1.37	5.14	71.30	1.35	10.06	1.76	Do.
	Coe's Prolific	do	1878	------	9.55	1.45	3.98	72.70	2.19	10.13	1.62	Do.
	Benton	do	1878	------	10.70	1.57	5.00	71.40	1.36	9.97	1.60	Do.
	Scioto	do	1878	------	10.43	1.53	4.01	72.98	1.80	9.25	1.48	Do.
	White Ohio	do	1878	------	9.70	1.79	4.20	71.30	1.73	11.28	1.80	Do
	Wisconsin	do	1878	------	9.72	1.56	4.89	70.17	2.06	11.60	1.85	Do.
	White Prolific	do	1878	------	10.14	1.67	4.28	73.38	1.34	9.19	1.47	Do.
	Extra Early Adam's	do	1878	------	10.94	1.75	4.81	70.21	1.48	10.81	1.73	Do.
	Tuscarora	Unclassified	1877	------	11.25	1.47	5.74	68.82	1.28	11.44	1.83	Do.
	NORTH CAROLINA:											
	North White	Flint Corn	------	------	11.17	1.31	4.70	70.04	1.90	10.88	1.74	S. W. Johnson.
	INDIANA:											
	White Oil	Dent Corn	------	------	11.29	1.28	4.87	70.16	1.90	10.50	1.68	R. C. Kedzie.
	MICHIGAN:											
	Smut Nose	Flint Corn	------	------	12.90	1.54	4.94	66.81	2.00	11.81	1.89	R. C. Kedzie.
	Do	do	------	------	13.26	1.49	5.14	66.11	2.49	11.51	1.84	Do.
	Eight-rowed Flint	do	------	------	13.45	1.43	4.83	66.03	2.26	12.00	1.92	Do.
	Sanford	do	------	------	13.37	1.37	5.06	67.41	2.10	10.69	1.71	Do.
	Yellow Dent	Dent Corn	1877	------	12.74	1.41	4.63	66.98	2.49	11.75	1.88	Do.
	Do	do	1877	------	11.66	1.51	5.07	67.80	2.48	11.48	1.51	Do.
	White Dent	do	1877	------	13.73	1.60	4.63	66.26	2.26	11.52	1.52	Do.
	Hackberry Dent	do	1877	------	12.47	1.47	4.77	69.11	2.30	9.88	1.58	Do.
	Strawberry Roan	do	1877	------	14.05	1.39	4.59	67.63	2.03	10.31	1.65	Do.
	Pony Dent	do	------	------	13.42	1.40	4.83	66.94	2.16	11.25	1.80	Do.
	Do	do	------	------	13.29	1.31	5.03	67.53	2.21	10.63	1.70	Do.
	Tuscarora	White Flint	1877	------	14.08	1.52	5.77	65.97	1.80	10.86	1.74	Do.
	UNKNOWN:											
	Western Yellow	Flint Corn	------	------	13.93	1.25	3.92	70.49	1.59	8.82	1.41	W. O. Atwater.
	Southern White	do	------	------	13.82	1.32	4.02	71.16	.88	8.80	1.41	Do.
	Early Dutton	do	------	------	8.08	1.52	5.64	72.62	2.52	9.62	1.54	Do.
	Common Yellow, or Canada	do	------	------	10.52	1.31	4.42	71.63	2.40	9.72	1.56	Do.

	King Philip, or Rhode Island	ditto			9.79	1.60	4.45	70.08	2.21	11.87	1.90	Do.
	MISSOURI:											
1260	Pennsylvania	Yellow Flint		30.674	8.25	1.55	4.05	74.27	1.90	9.98	1.60	Dep't of Agric.
1261	Pale Yellow	Yellow Dent		44.251	8.55	1.65	5.16	72.29	2.55	9.80	1.60	Do.
1262	Golden Dent			35.336	7.50	1.50	4.76	71.51	1.95	12.78	2.04	Do.
1263	Early Canada	Yellow Flint		37.077	8.70	1.45	4.67	72.50	2.00	10.68	1.71	Do.
1264	Chester County Mammoth	Yellow Dent		39.807	7.60	1.85	6.93	70.34	2.95	10.33	1.65	Do.
1265	New Madrid	ditto		32.031	7.40	1.50	5.81	71.96	2.65	10.68	1.71	Do.
1266	Early Yellow	ditto		39.624	7.90	1.75	5.43	73.41	2.58	8.93	1.43	Do.
1267	Evans	ditto		40.962	9.05	1.50	4.73	73.24	2.55	8.93	1.43	Do.
1268	Gold Dust	ditto		43.263	8.75	1.55	4.95	70.92	2.28	11.55	1.85	Do.
1269	Bloody Butcher	Red Dent		37.774	8.70	1.70	4.78	72.61	2.23	9.98	1.60	Do.
1270	Long Yellow	Yellow Dent		38.062	8.80	1.30	4.88	73.04	2.00	9.98	1.60	Do.
1271	Jersey Red	Red Dent		45.870	8.30	1.75	4.39	72.26	2.45	10.85	1.74	Do.
	KANSAS:											
1962	Yellow Dent			34.436	11.84	1.69	5.11	68.82	2.04	10.50	1.68	Dep't of Agric.
1963	Striped Red and Yellow Dent			32.206	12.10	1.60	4.66	69.09	2.40	10.15	1.62	Do.
1964	Dark Red Dent			32.150	12.26	1.36	4.47	68.93	2.65	10.33	1.65	Do.
1965	White Dent			35.798	12.06	1.56	5.69	68.44	2.10	10.15	1.62	Do.
1966	Yellow Dent			28.348	11.40	1.30	4.77	71.72	1.71	9.10	1.46	Do.
1967	White Dent			36.687	12.00	1.44	4.49	69.34	2.05	10.68	1.71	Do.
	COLORADO:											
1237	Blount's Prolific	Flint	1882	34.120	10.50	1.50	5.66	70.19	2.35	9.80	1.60	Dep't of Agric.
	TEXAS:											
1279	Wild Goose			43.799	8.40	1.45	4.91	72.71	2.20	10.33	1.65	Dep't of Agric.
1945	White and Yellow Dent Cross			31.364	10.10	1.44	5.33	68.96	3.84	10.33	1.65	Do.
1946	White Dent			40.926	9.70	1.70	5.10	69.25	3.22	11.03	1.76	Do.
1947	Red and Yellow Cross Dent			38.517	10.00	1.40	5.42	71.38	1.82	9.98	1.60	Do.
1948	Yellow and White Dent			38.465	10.36	1.04	5.29	70.02	2.61	10.68	1.71	Do.
1949	Red Dent			40.245	10.44	1.44	5.62	69.67	2.68	10.15	1.62	Do.
1950	White, Red, and Yellow Dent			36.366	10.52	1.60	5.20	68.07	4.81	9.80	1.57	Do.
1951	White Dent			40.881	10.84	1.56	5.57	69.12	2.41	10.50	1.68	Do.
1952	Do			40.435	10.60	1.32	5.32	67.74	4.17	10.85	1.74	Do.
1953	Yellow, Red, and White Dent			38.855	10.42	1.40	5.48	70.49	2.06	10.15	1.62	Do.
1954	White Dent			39.986	10.20	1.63	5.26	69.92	2.31	10.68	1.71	Do.
1955	Red and White Dent			31.547	10.14	1.38	4.97	70.78	2.40	10.33	1.65	Do.
1956	Yellow, Red, and White Dent			39.655	10.90	1.30	5.75	69.06	2.66	10.33	1.65	Do.
1557	Yellow, White, and Red Dent			38.526	10.05	1.49	5.36	70.19	2.23	10.68	1.71	Do.
1958	Do			39.583	10.49	1.52	5.58	69.65	2.96	9.80	1.57	Do.
1959	Yellow and White Dent			39.195	9.27	1.38	6.11	70.95	2.14	10.15	1.62	Do.
1960	White Dent			36.150	10.50	1.42	5.51	69.34	2.55	10.68	1.71	Do.
1968	Yellow Dent			32.398	11.98	1.32	5.15	67.79	2.73	11.03	1.76	Do.
1969	Yellow, Red, and White Dent			38.871	12.13	1.37	6.57	66.69	2.91	10.33	1.65	Do.
1970	White Dent			30.898	11.82	1.18	5.46	68.63	2.76	10.15	1.62	Do.
	OREGON:											
30	Oregon White	White Corn	1878		9.25	1.46	7.08	73.07	1.26	7.88	1.26	Dep't of Agric.
	WASHINGTON TERRITORY:											
1236	Yakima City	Flint	1882	27.900	10.30	1.50	5.73	71.19	2.88	8.40	1.34	Dep't of Agric.
	MEXICO:											
27	White Mexican	White Corn	1878		8.65	1.87	4.90	72.79	1.64	10.15	1.62	Dep't of Agric.
29	Mexican White Dent	White Dent	1878		11.14	1.45	6.28	68.87	1.59	10.67	1.71	Do.
41	Mexican	Blue Corn	1878		8.97	1.42	5.25	72.35	1.80	10.21	1.63	Do.

ANALYSES OF AMERICAN CORN BY STATES—CONTINUED.

Number.	Name.	Variety.	Date.	Weight of 100 kernels.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Analyst.
				Grams.	*Pr.cent.*	*Pr.cent.*	*Pr.cent.*	*Pr.cent.*	*Pr.cent.*	*Pr.cent.*	*Pr.cent.*	
	UNKNOWN:											
1224	Queen of the Prairie	Field Corn, Department Seed	1882	25.782	9.40	1.55	4.29	71.06	2.85	10.85	1.74	Dep't of Agric.
1274	Mexican No. 9	Blue, Black, Red, and White Corn, Department Seed.	.....	23.605	8.35	1.75	7.13	73.74	2.03	7.00	1.12	Do.
1278	Mexican	Flint Corn, Department Seed	.....	40.734	7.95	1.30	5.53	74.62	2.20	8.40	1.34	Do.
45	Pop Corn	White, Department Seed	1878	.....	8.61	1.63	5.63	68.68	2.32	13.13	2.10	Do.

Number.	Name.	Locality.	Date.	Weight of 100 kernels.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Analyst.
				Grams.	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	
18	Stowell's Evergreen	New England	1878	.....	5.98	1.92	8.00	69.53	2.66	11.91	1.90	Dep't of Agric.
21	Golden	Massachusetts	1878	.....	6.27	1.93	9.17	66.70	1.58	14.35	2.30	Do.
22	Marblehead Mammoth	....do	1878	.....	6.47	1.92	9.00	67.95	1.88	12.78	2.04	Do.
24	Proctor's	....do	1878	.....	10.13	1.92	7.95	66.17	1.75	12.08	1.93	Do.
1273	Black Sugar	Pennsylvania	.....	27.392	8.50	1.90	8.88	65.81	3.53	11.38	1.82	Do.
1275	Darling's Sugar	....do	.....	21.635	7.80	1.95	9.08	67.64	3.03	10.50	1.68	Do.
1276	Egyptian	....do	.....	25.359	7.40	1.70	8.08	68.01	3.08	11.73	1.88	Do.
1277	Stowell's Evergreen	....do	.....	23.478	7.00	2.35	11.89	62.45	4.58	11.73	1.88	Do.
19	Egyptian	Maryland	1878	.....	7.54	1.92	7.80	69.17	2.02	11.55	1.85	Do.
1220	Stowell's Evergreen	Department Seed	1882	15.717	7.85	2.25	7.83	69.12	3.50	9.45	1.51	Do.
1221	Roslyn Hybrid	....do	1882	24.319	7.85	1.75	8.77	66.41	5.24	9.98	1.60	Do.
1222	Early Minnesota	....do	1882	29.251	9.50	2.10	9.12	65.56	3.14	10.58	1.69	Do.
1223	Egyptian	....do	1882	16.475	8.10	2.15	7.96	68.05	3.76	9.98	1.60	Do.
1961	Sugar Corn	Kansas	.....	16.501	10.76	1.90	8.06	65.85	3.10	10.33	1.65	Do.
20	Red River	Minnesota	1878	.....	9.13	1.89	9.31	66.48	1.46	11.73	1.88	Do.
23	Prolific	.....	1878	.....	10.38	1.87	7.65	67.73	2.04	10.33	1.65	Do.
	Sweet	Connecticut	1877	.....	9.45	2.06	9.13	63.05	1.93	14.38	2.30	S. W. Johnson.
	Stowell's Evergreen	....do	.....	.....	10.86	1.89	7.66	65.86	2.63	11.10	1.61	W. O. Atwater.
	Mammoth	....do	1878	.....	9.43	1.93	7.48	66.09	2.75	12.32	1.98	S. W. Johnson.

AVERAGES.

From the preceding results, averages have been calculated as in the case of wheat. The sugar corns are not included, as it will be seen that they are of quite a different composition from field corn and should be therefore considered by themselves.

AVERAGE COMPOSITION OF AMERICAN CORN (MAIZE).

	Weight of 100 kernels.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Weight of largest 100 kernels.	Weight of smallest 100 kernels.	Highest albuminoids.	Lowest albuminoids.	No. of analyses.	No. of weights of 100 kernels.	Analyst.
	Grams.	*Pr. ct.*	*Pr.ct.*	*Pr.ct.*	*Pr. ct.*	*Pr.ct.*	*Pr. ct.*	*Pr.ct.*	*Grams.*	*Grams.*	*Pr. ct.*	*Pr. ct.*			
America	36.910	10.04	1.52	5.20	70.69	2.09	10.46	1.67	52.679	23.605	13.65	7.00	114	61	
Northern States	37.320	9.98	1.54	5.11	71.32	1.41	10.64	1.70	44.147	30.610	13.65	7.53	30	3	
South		8.96	1.37	4.94	72.06	1.72	10.95	1.75			11.03	10.88	2		
Middle West	32.457	12.33	1.43	4.97	68.16	2.22	10.89	1.70			12.00	9.29	15	1	
Far West	37.528	9.50	1.55	5.30	70.75	2.47	10.43	1.67	52.679	28.348	12.78	8.23	53	53	
Pacific slope	27.900	9.78	1.48	6.40	72.13	2.07	8.14	1.30			8.40	7.88	2	1	
Mexico		9.58	1.58	5.48	71.34	1.68	10.34	1.65			10.67	10.15	3		
New Hampshire		10.10	1.58	5.48	70.15	1.11	11.67	1.85			13.65	10.50	11		Department of Agriculture.
Vermont		8.64	1.45	5.63	72.76	1.38	10.14	1.62					1		Do.
Connecticut		10.84	1.54	4.70	70.98	1.46	10.48	1.69			11.63	9.19	13		S.W.Johnson, W.O.Atwater.
Pennsylvania	37.320	7.96	1.43	5.22	74.54	1.97	8.88	1.42	44.147	30.610	10.15	7.53	5	3	Department of Agriculture.
North Carolina		8.96	1.37	4.94	72.06	1.72	10.95	1.75			11.03	10.88	2		Johnson and Dept.
Kentucky	32.457	7.70	1.50	5.33	73.47	2.20	9.80	1.57					1		Department of Agriculture.
Tennessee		7.58	1.23	5.09	74.16	2.65	9.29	1.48					1		Do.
Indiana		11.29	1.28	4.87	70.16	1.90	10.50	1.68					1		R. C. Kedzie.
Michigan		13.20	1.45	4.95	67.05	2.21	11.14	1.73			12.00	9.88	12		Do.
Missouri	38.411	8.18	1.68	5.28	72.00	2.33	10.54	1.68	52.679	30.674	12.78	8.23	26	26	Department of Agriculture.
Kansas	33.271	11.94	1.49	4.87	69.39	2.16	10.15	1.62	36.687	28.348	10.68	9.10	6	6	Do.
Colorado	34.120	10.50	1.50	5.66	70.19	2.35	9.80	1.60					1	1	Do.
Texas	37.833	10.44	1.42	5.45	69.52	2.77	10.40	1.66	43.799	30.898	11.03	9.80	20	20	Do.
Oregon		9.25	1.46	7.08	73.07	1.26	7.88	1.26					1		Do.
Washington Territory	27.900	10.30	1.50	5.73	71.19	2.88	8.40	1.34					1		Do.
Mexico		9.58	1.58	5.48	71.34	1.68	10.34	1.65			10.67	10.15	3		Do.

The average American corn as compared with the averages of foreign investigators, which no doubt include many of our corns, stands in quite a different position from wheat.

AVERAGE OF AMERICAN CORN COMPARED WITH AVERAGES OF FOREIGN INVESTIGATIONS.

	Richardson.	Koenig.	Wolff.
Water	10.04	13.12	14.40
Ash	1.52	1.51	1.50
Oil	5.20	4.62	6.50
Carbhydrates	70.69	68.41	62.10
Fiber	2.09	2.49	5.50
Albuminoids	10.46	9.85	10.00
	100.00	100.00	100.00
Nitrogen	1.67	1.58	1.60
Number of analyses	114	145	.....

There is no marked difference between the averages, except in the matter of water, where, as in wheat, our grain is much drier. The American corn is rather better than the foreign article, if anything.

In the averages for different sections of the country another fact is discovered which, after our experience with wheat, is still more surprising than the result of the comparison of American and foreign corns.

There is apparently the same average amount of ash, oil, and albuminoids in a corn wherever it grows, with the exception of the Pacific slope, where, as with wheat, there seems to be no facility for obtaining or assimilating nitrogen.

The amount of water is variable, but, as has been said, many of the samples had been on exhibition for a considerable time, and were consequently dried out.

The increase in the fiber from East to West is not paralleled in the wheat, but, as we have seen, is often a feature of increased vigor.

Corn is, then, an entirely different grain from wheat. It maintains about the same percentage of albuminoids under all circumstances, and is not affected by its surroundings in this respect.

A study of the averages for each State shows that the samples from Pennsylvania and from Oregon and Washington Territory fall much below the average and that those from New Hampshire rise above it. The preponderance of averages for single States which do not vary 1 per cent. proves, however, that corn is much more stable in its composition than wheat, even though New Hampshire contains an extreme of 11.67 per cent. average albuminoids, and Pennsylvania, Oregon, and Washington Territory, extremes of 8.88, 8.40, and 7.88 per cent.. Only two analyses have been made from the Pacific slope and more are needed for confirmation, but as the two analyses, like those of the wheats grown there, are low in albuminoids it may safely be assumed to be a characteristic of that portion of the country.

Having discussed the averages it is of interest to see how wide the variations in composition are:

VARIATIONS OR EXTREMES FOR EACH CONSTITUENT OF CORN.

Constituent.	Highest. percentage.	Lowest. percentage.	Variation.	Above average.	Below average.
Water	15.10	7.40	7.70	5.06	3.64
Ash	2.10	1.18	.92	.58	.34
Oil	7.49	3.92	3.57	2.29	1.28
Carbhydrates	75.73	65.97	9.76	5.04	4.72
Fiber	3.10	.78	2.32	1.01	1.31
Albuminoids	13.65	7.00	6.65	3.19	3.46
Weight of 100 kernels ....grams..	53.679	23.605	29.074	15.769	13.305

The variation in water has been explained, that of ash is remarkably small, of oil and fiber proportionately the same as in wheat, while albuminoids has not nearly so wide a variation, and, in fact, in the analyses of the one hundred and fourteen corns only three contain less than 8 per cent., two more than 13 per cent., and seven more than 12 per cent., so that the usual limits may be said to lie between 8 and 12 per cent., and this is true of the analyses of foreign maize given by Koenig.

Our conclusion must be, then, that corn can supply itself with nitrogen under varied circumstances, but that it rarely is able to assimilate more than a certain amount, nor will it fall far below this amount. The bushels of crop may vary and the size of the grain, but the quantity of albuminoids is practically unchangeable.

Under these circumstances it is perhaps needless to say that there is but slight variation in composition between different kinds of corn.

Red Dent is slightly inferior, but the remaining varieties are practically of the same composition.

Sugar corn is, however, quite distinct from the field or hard corns. Its average composition compared with the average of all the hard corns shows a much higher percentage of oil and somewhat higher ash, fiber, and albuminoids. The grain dries out more than the field corn and weighs less.

AVERAGE COMPOSITION OF SUGAR AND FIELD CORN.

	Sugar.	Field.
Number of analyses	19	114
Water ....per cent..	8.44	10.04
Ash ....do....	1.97	1.52
Oil ....do....	8.57	5.20
Carbhydrates ....do....	66.72	70.69
Fiber ....do ..	2.82	2.09
Albuminoids ....do....	11.48	10.46
Nitrogen ....do....	1.84	1.67
Weight of 100 kernels ....grams..	22.236	.910

OTHER CEREALS THAN CORN AND WHEAT.

Sufficient analyses of other American cereals have not been made to determine what effect environment has had upon them. From foreign analyses it is possible to calculate the variations which are usually found, and it is fair to suppose that as the agreement is close with corn and wheat, it would be so in the remaining cereals. For this purpose the large collection by Koenig of analyses of cereals has been employed. The analyses of each serial are divided into percentages of the whole number made, according to the amount of albuminoids which they contain. It was then found that of this number 75 per cent. would fall within certain limits which might be regarded as the ordinary variation to be expected. The extremes are as follows:

Extremes of albuminoids in different cereals.

	For all analyses.		For 75 per cent. of the analyses.	
	Highest.	Lowest.	Highest.	Lowest.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Wheat	24	5	14	8
Barley	18	6	14	8
Oats	18	6	13.8	9
Rye	15	8	13	9.25
Corn	15	5	10	6.83

The probable variation in a wheat, therefore, is 6 per cent., barley 6 per cent., oats 4.8 per cent., rye 3.75 per cent., and corn 2.3 per cent.

Wheat and barley have the widest variation, followed by oats and rye, corn having the smallest.

It is apparent then that wheat and barley must be more susceptible to their supply of nitrogen than corn, which coincides with the results of Atwater's field experiments with various fertilizers. He found that corn responded less than other cereals to nitrogenous fertilizers.

In closing this paper it must be said that many of the conclusions arrived at in the preceding pages are not intended as final or advanced in the light of anything more than possible deductions from the data at hand. Their absolute truth can only be decided by a more extended investigation.